THE REFINER AND NATURAL GASOLINE MANUFACTURER

FEBRUARY, 1927

NEWS INDEX 45
ADVERTISERS INDEX 130

JOHN CREAR
FEB 7 1927
LIBRARY

VOLUME 6 NUMBER 2

JENKINS CRACKING PROCESS

PRODUCES QUALITY GASOLINE

Facts from performance

January 1, 1927

32 Units

operating or under construction in

15 Refineries

62½% of the 1926 Sales were repeat orders

GRAVER Corporation Founded 1857

EAST CHICAGO, INDIANA

NEW YORK Grand Cent. Term. | CHICAGO Steger Building | TULSA Atlas Life Bldg. | HOUSTON West Building

BRAUN

MOBILE DISTILLATION UNITS

Pictured above is a BRAUN Type "G" Mobile* Distillation Unit, with fat oil tank in foreground. Capacity as high as 15,000 gallons gasoline, depending upon conditions. Other BRAUN Portable, Mobile, and Fabricated Plants with capacities from 2,500 to 20,000 gallons per 24 hours.

*BRAUN Mobile plants are built, assembled and tested at the Alhambra factory. They are then shipped in convenient portable sections and re-erected in the field by bolting together frames and a few pipe flanges.

BRAUN

C. F. BRAUN & CO.
Manufacturing Mechanical Engineers
ALHAMBRA, CALIFORNIA
New York Dallas Tulsa

Entered as second class matter June 16th, 1923, at the Postoffice at Houston, Texas, under the Act of March 3, 1879.

NEILAN

A mark of eminent distinction in a highly specialized field of endeavor . . . . . symbolizing a new high standard of perfection in accurate and positive pressure regulation and the control of liquid levels.

Neilan is the trade name of a full line of regulating devices for accurate and positive pressure regulation and the control of liquid levels, which have attained a new high standard of perfection in operation.

The exceptional success of these devices in service is due to more perfect operation through advanced improvements upon previous practice, backed by high quality, modern design, precision manufacture and integrity of purpose.

Pilot Sensitive Back Pressure Gas Regulator No. 45.

A Partial List of "Neilan" Products

Reducing Regulators
Back Pressure Regulators
Casing Head Regulators
Vacuum Regulators
Orifice Valves
Gas Fuel Boiler Governors
Balanced Lever Valves
Float Valves
Supersensitive Vapor Recovery System
Steam Reducing Valves
Pump Governors
Liquid Level Controllers
Gasoline and Water Separation Controllers
Steam Traps
Gasoline Traps
Air Relief Valves
Water Reducing Valves
Altitude Valves
Cushioned Noiseless Check Valves
Vacuum Relief Valves

NEILAN, SCHUMACHER & CO.
641-643 Santa Fe Avenue
Los Angeles, California

Representatives:

Maintenance Engineering Corp.,
2000 Harrington Street,
Houston, Texas

Pelican Well Tool & Supply Co.,
Shreveport, La.

You Can Be Sure of "Neilan" Products

SAFEMCO

PAINTS

Made for the Southwestern Oil Industry —THEY STAND UP

"A Can or a Carload"

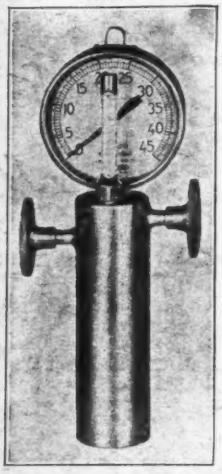
AMERICAN PAINT & SUPPLY COMPANY

DALLAS, TEXAS

Mention Where You Saw the Advertisement

THE AC-ME Look Box

Strongest, safest, greatest visibility. Lenses tested at 400 pounds per sq. in., and will not crack under temperature differences. Made for 1", 1½" and 2" connections. Write for Bulletin No. 4.



The AC-ME Vapor Tension Bomb

Standardized results. Armored Immersion Thermometer gives temperature of gasoline direct. Thermometer and gauge not removed, eliminating possibility of leaks. Gets representative sample, automatically draining 10%. Lead seated hand wheel caps. Quick, accurate, consistent results.

Write for Bulletin No. 5

The AC-ME Loading Dome Cover

Fits either 6 or 8 bolt domes, safe, gas tight, greatest visibility, strongest lenses. Lightest to handle, cheapest to buy.

Write for Bulletin No. 6.

The AC-ME Calculator for Orifice Meters

Quick direct results easily read.

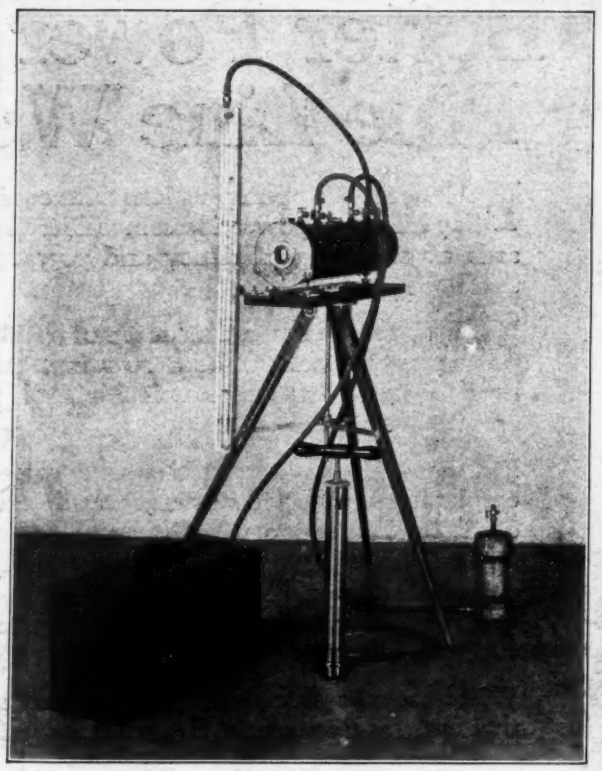
Write for Bulletin No. 1A

For 10-inch pocket calculator, Bulletin No. 1B

The AC-ME Recording Gravitometer

Records the specific gravity of gas. Strong, rugged, reliable, accurate. 24 Hr. or 7 Day charts.

Write for Bulletin No. 2



THE AC-ME GRAVITY BALANCE

For determining the Specific Gravity of Natural Gas.

Absolutely accurate and dependable. Rugged in construction. Has twice the power of any balance on the market, insuring reliable results. Has float shaped so that it will not change its volume under pressure, as specified by the Bureau of Standards. The only gravity balance in which the oscillations can be dampened, and THE FLOAT MECHANISM LOCKED FOR TRANSPORTATION, WITHOUT OPENING THE BALANCE. Supplied with all necessary equipment, and with full instructions, for operation. Supplied with a new double acting pressure and vacuum pump tested to pull 28" mercury vacuum.

Write for Bulletin No. 3.

THE AC-ME COMPANY

3225 Swiss Avenue — Dallas, Texas

Specialties for the Oil and Gas Industry

Better Power for Pipe Line Work

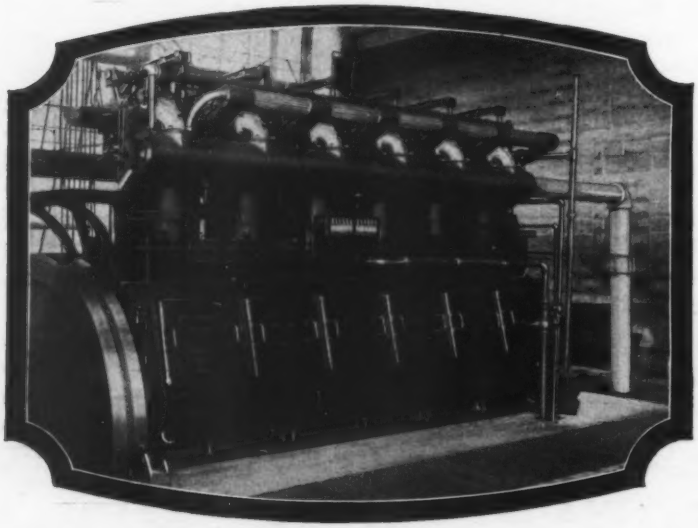
FOR heavy duty pumping jobs that require steady, day after day power, Bessemer Diesels set standards of operating efficiency and power economy that are not excelled.

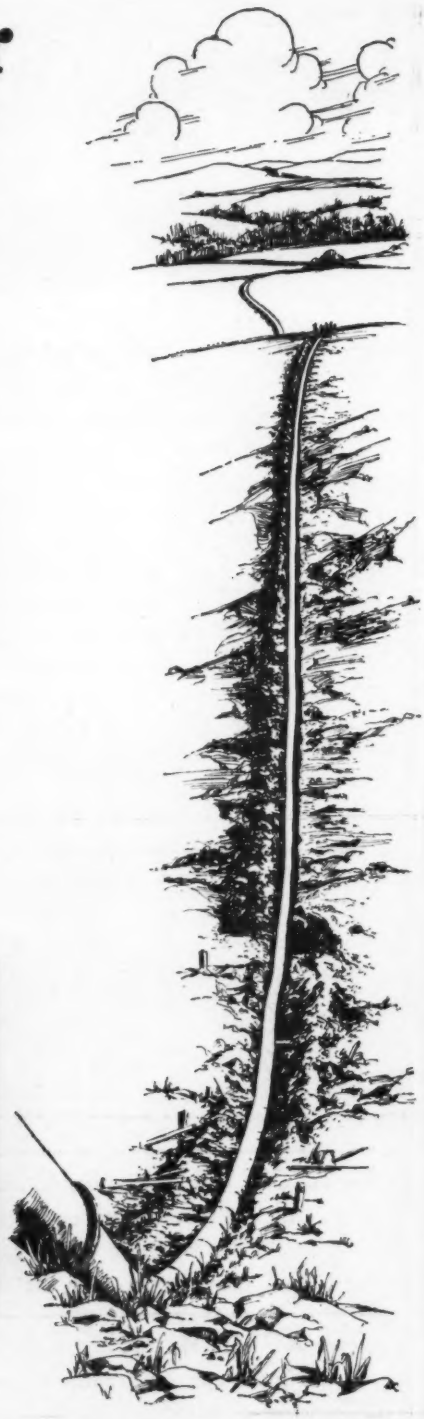
Not only are Bessemers a source of steady, surging power, but they are smooth running, quiet, long-lived, and decidedly economical in both operation and maintenance.

Bessemer Diesels are of the solid injection type employing a perfected Bessemer mechanical system of fuel oil injection which assures fuel economy and engine efficiency. They are ruggedly built to deliver uninterrupted power for months at a time, and will turn up their full rated horse-power easily and consistently.

Write for complete details and operating records that prove Bessemer's outstanding performance.

THE BESSEMER GAS ENGINE COMPANY
18 York Street ∴ ∴ Grove City, Pa.





BESSEMER

BESSEMER OIL FIELD ENGINES – COMPRESSORS VACUUM PUMPS – ROLLER PUMPING POWERS

Mention Where You Saw the Advertisement

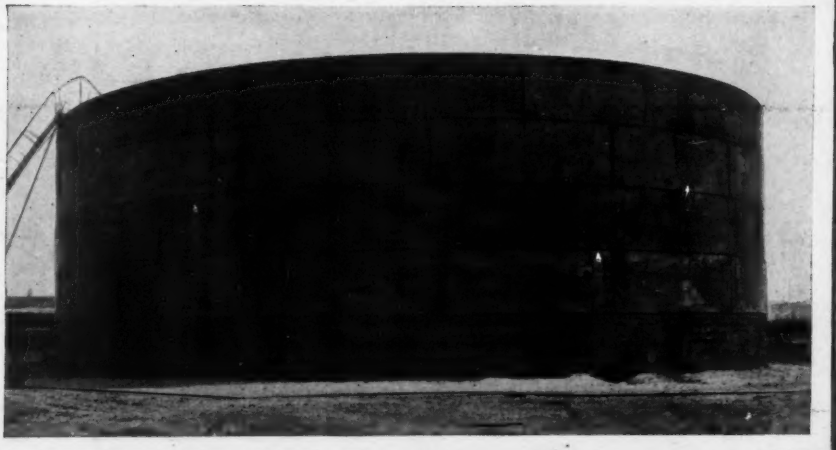
Strength You Can Depend Upon

The SUPER STRENGTH built into every piece of KAW refinery equipment is a quality you can depend upon to save you time, trouble and money. It is a strength that withstands the ravages of time and weather. It is a strength that pays dividends in worry-free reliability year after year.

Let the strong, durable, economical qualities of KAW products give you the assurance of equipment you can depend upon to deliver the day-in and day-out service you want.

Write, wire or phone for specifications and prices now on Horizontal Tanks, Condenser Boxes, Rundown Tanks, Storage Tanks, Agitators, Towers, Stacks or Stills.

KAW



THE KAW STEEL CONSTRUCTION CO.

General Office and Plant: 1st and Walker Ave. Kansas City, Kansas

BANROC JACKET

BANROC PRODUCTS

This is number four of a series of pages which tell the story of BANROC JACKET.

1. Adaptable
2. Flexible
3. Permanent
4. Reclaimable
5. Efficient
6. Economical

BANROC is so durable, parts will wear out long before

BANROC has really commenced its service.

BANROC is 100% efficient the instant it is applied.

BANROC JACKET may be used for other purposes after the parts it has protected have worn out—because of its permanent flexibility it may again be used on other parts of like surface dimension—this is true economy!

Buy **BANROC** once it will serve you always—adjust it as you please.

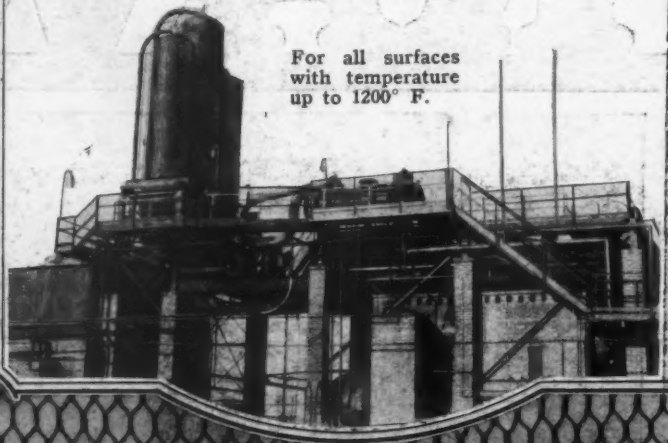
Standard sizes, 2x4 ft. and 2x8 ft., special sizes to meet your requirements.

You'll be interested in samples and booklet 24-R.

Write for them, the obligation is ours.

BANROC JACKET

100% FIREPROOF INSULATION



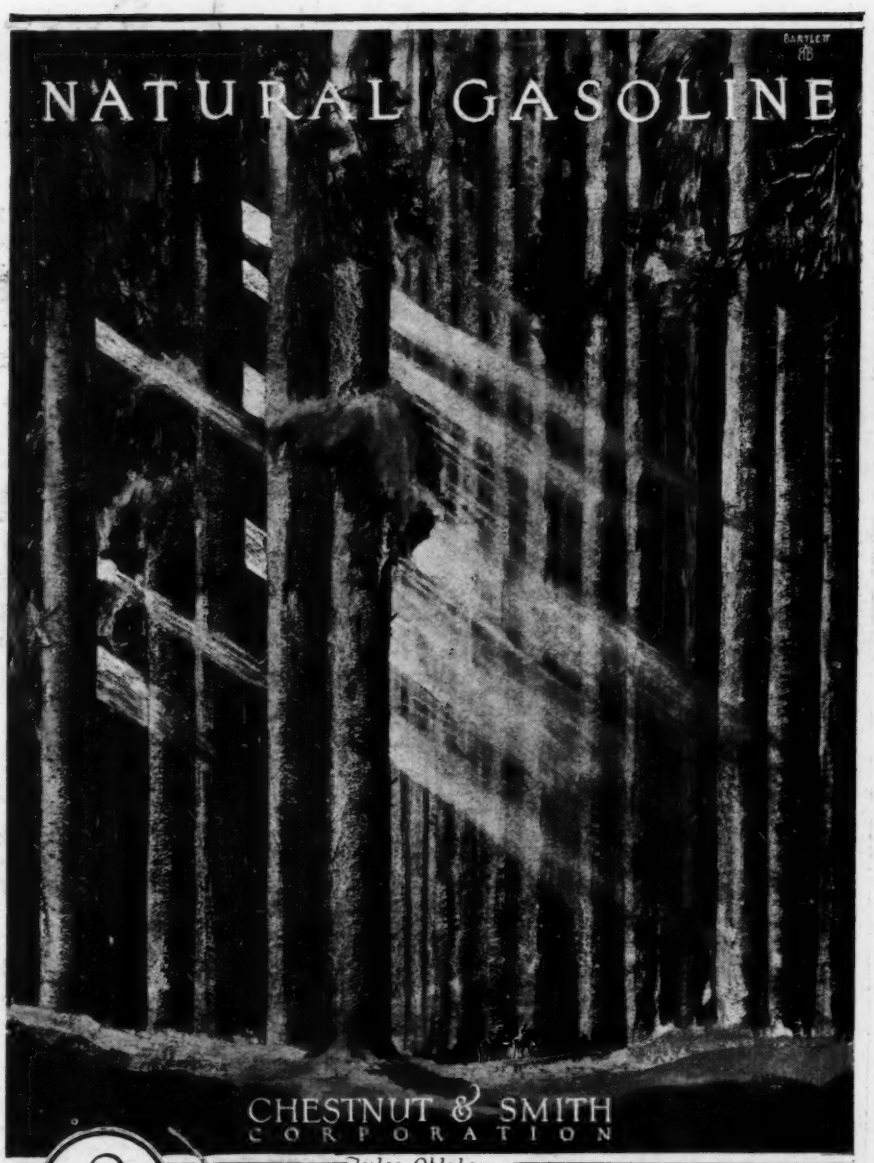
For all surfaces with temperature up to 1200° F.

BANNER ROCK PRODUCTS COMPANY

ALEXANDRIA, INDIANA

REPRESENTATIVES IN ALL PRINCIPAL CITIES

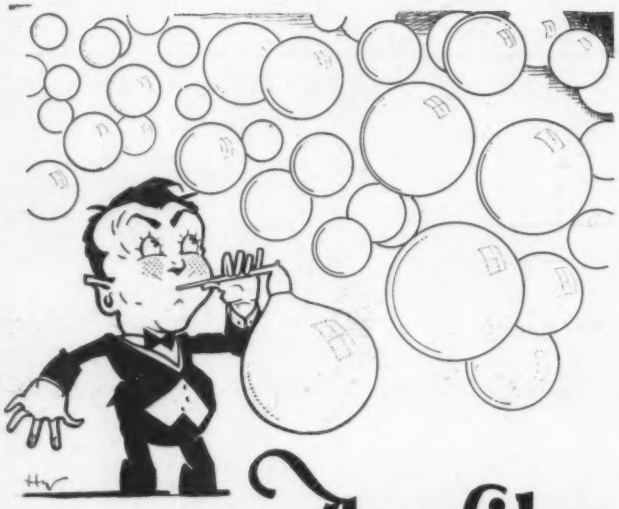
Mention Where You Saw the Advertisement



To stand beneath the great Redwoods in abject insignificance — to look aloft into their tops brushing the clouds—to breast the great trunks in a futile embrace—that is to realize the breadth and greatness of nature's kingdom.

TWIGS OR TRUNKS

A tank car or a trainload a dependable source of Natural Gasoline supply.



The film on the bubble draws the gasoline out of the gas!

Extraction

of gasoline from natural gas is most efficiently accomplished by the absorption method whereby billions of bubbles serve as the medium for drawing the gasoline from the gas.

It therefore stands to reason that the greater the amount of bubble film area the higher will be the absorptive power of the lean oil which is the vehicle that carries the gasoline to the stills.

In Campbell Oil-Froth Absorbers the action of the wet gas and the lean oil forms a fine froth which permits intimate contact between gas and oil, thus effecting thorough absorption.

Campbell Absorbers have increased gasoline production in every plant where installed.

J. A. Campbell

Consulting—Designing—Construction
Natural Gas Engineer

P. O. Box 669 Long Beach, Calif.

CAMPBELL
OIL FROTH
absorber

These Leading Oil Refiners

The Texas Company
The Standard Oil Co.
The Gulf Refining Co.
The Empire Refineries, Inc.
The Barnsdall Refining Co.
Producers & Refiners Corp.
The Manhattan Oil Co.
Shreveport Pro. and Ref. Co.
New Oil Processing Co.

Use Laclede-Christy Flat Arches

on oil stills and boiler furnaces

Complete Information on Request

LACLEDE-CHRISTY, St. Louis, U. S. A.

Makers of Famous Laclede Fire Brick

L7

Vacuum!

for special processes

ELLIOTT AIR EJECTORS

The modern vacuum pump is a steam jet air ejector. The ejector in its various forms—single-stage, multi-stage, and in combined units with inter- and after-condensers, has all of the requirements of the ideal vacuum pump, and none of the disadvantages of older types.

Ejectors are amazingly simple and compact, requiring no attention, lubrication, supervision, or upkeep. They are extremely flexible, adapting themselves in one type or another to any set of conditions or vacuum requirements. They establish vacuum quickly. They may be designed for any operating steam pressure or for various pressures if need be. In many cases they have made possible the utilization of vacua formerly impossible.

Let us discuss the application of these modern vacuum producers to your particular requirements.

JEANNETTE, PA.
DISTRICT OFFICES
ATLANTA, BALTIMORE, BOSTON, CHICAGO, CINCINNATI, DETROIT, CLEVELAND, NEW YORK, KANSAS CITY, ST. LOUIS, PHILADELPHIA AND PITTSBURGH

ELLIOTT COMPANY

PRODUCTS
STEAM TURBINES, REDUCTION GEARS, RADIATORS, HEATERS, CONDENSERS, AIR EJECTORS, AUTOMATIC BLEED-BETWEEN VALVES, BLOW-OFF VALVES, GREASE EXTRACTORS, STRAINERS, SEPARATORS

C-290

Direct Vapor Phase Refining

of gasoline delivers the full yield from your cracking plant, as a product of high quality without removing or destroying the valuable anti-knock constituents.

Vapor Phase Plants are now being used or installed by the following companies:

Argentine Government Oil Fields, La Plata, Argentina.
Cia Ferrocarrilera de Petroleo, Campana, Argentina.
Alamo Refining Co., Amarillo, Texas.
Barnsdall Refineries, Inc., Barnsdall, Okla.
Barnsdall Refineries, Inc., Okmulgee, Okla.
Compagnie Belge du Gaz Catalytique, Brussels, Belgium.
Garber Refining Co., Garber, Oklahoma.
Kanotex Refining Co., Arkansas City, Kansas.
Lubrite Refining Co., East St. Louis, Illinois.
Marland Refining Co., Ponca City, Oklahoma.
McColl Bros., Ltd., Toronto, Canada.
Standard Oil Co. of N. Y., Brooklyn, N. Y.
Sun Oil Co., Marcus Hcok, Pennsylvania.
Texas Pacific Coal & Oil Co., Fort Worth, Texas.
Vacuum Oil Co., Paulsboro, N. J.
White Star Refining Co., Wood River, Illinois.

Vapor Phase Refining

delivers a higher yield of gasoline of better quality at a lower cost.

Write us for information

THE GRAY PROCESSES CORPORATION
961 FRELINGHUYSEN AVENUE
NEWARK, N. J.

High Quality and Accuracy *over all* Oil and Gas Fields

Based Upon

—1—

Thirty-eight years of meter-making experience.

—2—

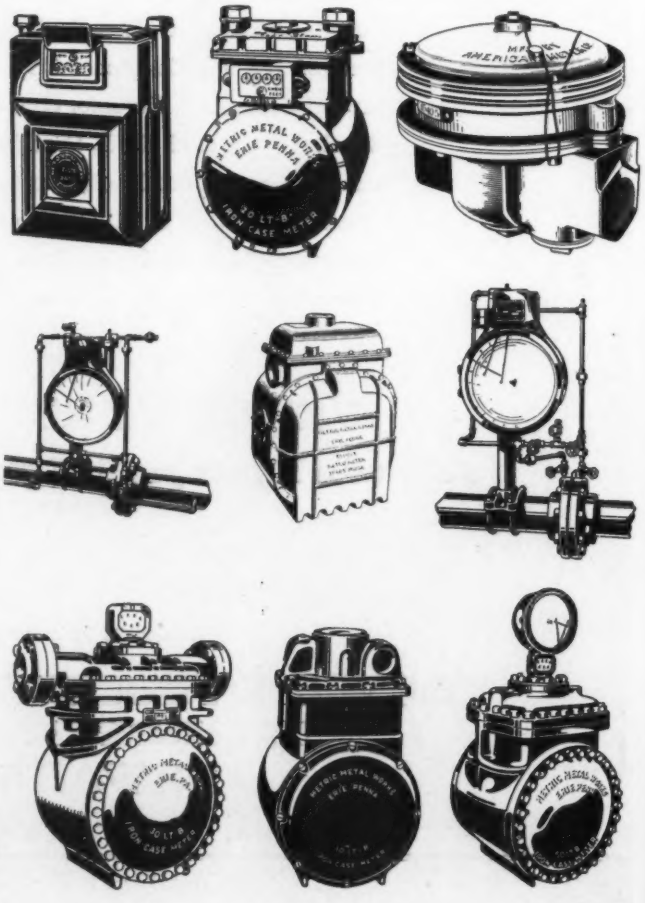
An always available service and interest that follows every meter from the factory to the job.

—3—

The most modern and most extensive facilities of the largest meter manufacturer.

—4—

The standard for excellence in design, materials and workmanship.



WESTCOTT & GREIS, Inc.
SALES—SERVICE
Dallas Houston Los Angeles

METRIC METAL WORKS
· ERIE · PENNSYLVANIA · U·S·A ·

SMITHSTEEL STILLS
built to meet any conditions You Specify!

HIGHER temperatures—higher pressures—greater volume—whatever trend the development of "cracking" methods may take, Smithsteel Cracking Stills will be built to meet the required conditions.

Today, Smithsteel Cracking Stills are being made in any dimensions, any wall thickness, and to meet any specified operating conditions. Refining engineers can thus design refining equipment to meet efficiency standards without regard to the limitations of stills obtainable.

Results obtained with Smithsteel Cracking Stills and the possibilities they offer are worth your investigation.

A. O. SMITH CORPORATION

TULSA *Milwaukee, Wis.* LOS ANGELES

For Every Process

Smithsteel Cracking Stills are built to meet the exact requirements of any refining process.

When considering the installation of new stills or the building of a new unit, a consultation with A. O. Smith engineers may be to your advantage.

SMITHSTEEL
CRACKING STILLS

Mention Where You Saw the Advertisement

They knew the need of clean tubes

A rifle is merely a tube. In order to do its best work it must be clean as a hound's tooth—and no frontiers-man would try to drive a nail at the regulation sixty paces unless the bore of his weapon was speckless.

Nor can any power plant or still operator hope to hit the bull's-eye of economical operation unless *his* tubes are groomed to the minute—clean, smooth and polished as Liberty Cleaners can make them. Users of Liberty Cleaners know that the continued application of these scale destroyers will help wonderfully to keep the cost curve down.

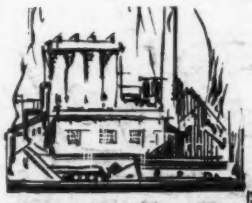
Don't attempt to enter the contest with dirty tubes—use Liberty Cleaners.

LIBERTY CLEANERS

LIBERTY MANUFACTURING COMPANY
Jeannette, Pa.

Z-1044

Mention Where You Saw the Advertisement



More could hardly be expected of a Thermometer Well or a Pyrometer Protection Tube than definite resistance to corrosion. But, Thermometer Wells and Pyrometer Protection Tubes made of Hills-McCanna No. 45 Alloy offer a good deal more—strength equal to that of steel—a coefficient of expansion 50 per cent greater than steel—higher thermal conductivity — tight joints—freedom from permanent-set by repeated heating and cooling.

Our well equipped machine shop and foundry stands ready to serve your needs, whether your preference lies in Tubes and Wells of Hills-McCanna No. 45, or steel, or any other commercial alloy.

The Corrosion Resisting Bronze With The Strength Of Steel

Pyrometer Protection Tubes Thermometer Wells

Higher Thermal Conductivity Therefore *Quicker and more Accurate Readings*

HILLS-McCANNA CO.

2029 Elston Ave., Chicago

FOUNDERS OF NON FERROUS ALLOYS SINCE 1870

HOPE
VERTICAL
GAS ENGINES

3 and 4 CYLINDERS — 60 to 250 H.P.

The purchase of a Hope Vertical Gas Engine is a sound investment in a dependable power supply. The greatest values covered by the hope price do not reveal themselves in any superficial comparisons — they are made manifest in the after years of smooth, trouble-free performance.

More than 20 years of intimate association with the natural gas industries have given Hope engineers an understanding of gas power development and application which is reflected in the character and economy of Hope Gas Engines.

Tell us the power you need, and let us send prices and specifications.

HOPE ENGINEERING & SUPPLY COMPANY
MT. VERNON, OHIO, U.S.A.

HOPE

ENGINEERS & CONTRACTORS IN NATURAL GAS AND OIL

HOPE

Mention Where You Saw the Advertisement

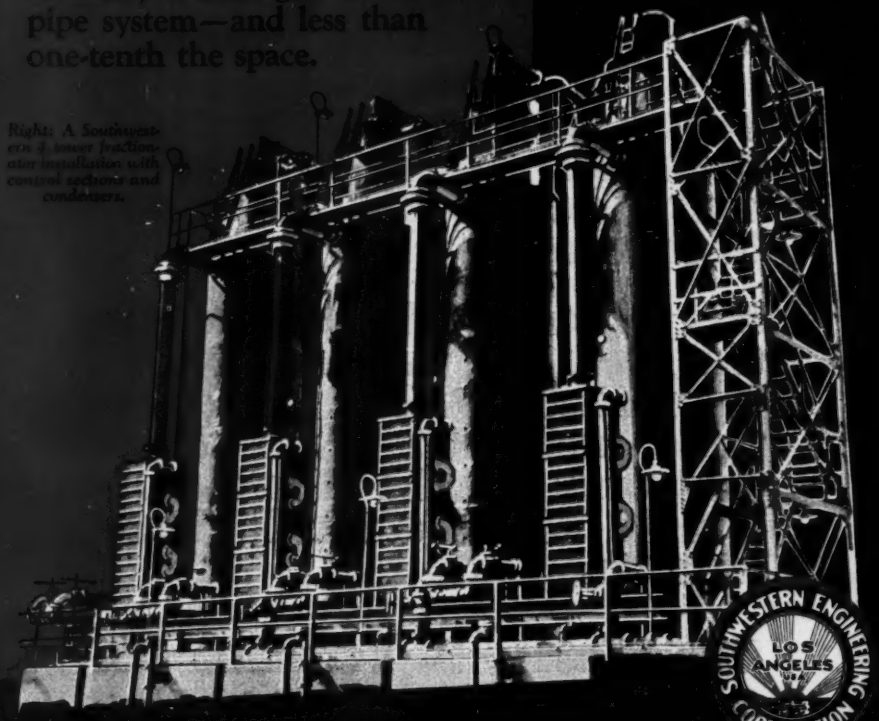
SOUTHWESTERN

CONDENSING SYSTEMS

(PATENTED)

The typical Southwestern Condensing System requires 80% to 90% less cooling surface than the ordinary submerged or double pipe system—and less than one-tenth the space.

Right: A Southwestern 3-tower fractionator installation with central recheck and condensers.



SOUTHWESTERN ENGINEERING CORPORATION LOS ANGELES U.S.A.

SOUTHWESTERN ENGINEERING CORP.

1221 HOLLINGSWORTH BLDG.

Los Angeles, Calif.

Offices
TULSA
AMARILLO, TEXAS
NEW YORK

Factories
CULVER CITY, CAL.
TULSA

Mention Where You Saw the Advertisement

The Walter E. Lummus Co.

Announces

THE addition to their sales department of Mr. G. H. Dillon, formerly in charge of sales of paraffine wax plant equipment for the Bethlehem Shipbuilding Co., and in 1920 their Oil Industry Representative located in Tulsa, Oklahoma.

Mr. Dillon will now handle the sale of Lummus Low Temperature Refining Systems and will have headquarters in the Boston office of The Walter E. Lummus Co.

The Walter E. Lummus Co.

Engineers and Builders of Refining Plants

173 Milk St., Boston, Mass.

109 Kingsway, London W.C. 2, England

Stamina Counts! in the Oil Industry!

STRENGTH, RIGIDITY, POWER OF ENDURANCE—THESE ARE THE FACTORS WHICH DETERMINE THE ULTIMATE COST OF YOUR VALVES.

The increasing necessity for lower operating costs in the oil industry is constantly influencing the installation of only such equipment as will render continuous satisfactory service with the least amount of attention and minimum maintenance expense.

LUNKENHEIMER "CLIP" GATE VALVES

have earned their place among the preferred equipment by paying their way in economical and trouble-free service.

They are sturdily constructed of the very best materials; Iron Body Bronze Mounted for steam, water or oil service, and All-Iron for handling fluids which attack bronze but not iron.

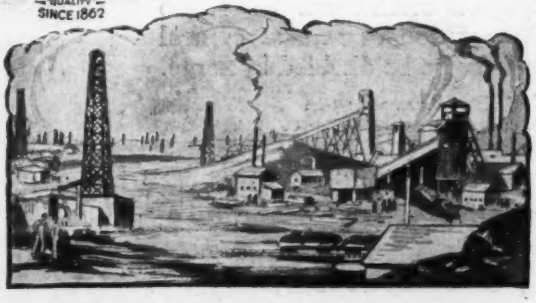
Lunkenheimer "Clip" Valves not only withstand 100 lb. W. S. P., but also the stresses caused by expansion and contraction, vibration, weight and settling of the pipe, and other severe service conditions.

Simplicity of design permits of quick and easy disassembling for cleaning or repairs, and the renewability of all parts subject to wear materially prolongs the life of the valve as a whole.

Distributors of Lunkenheimer Products are located in all oil producing centers. They can fill your requirements promptly from stock.

AMERICA'S BEST
LUNKENHEIMER
"QUALITY"
SINCE 1862

The Lunkenheimer **"Guide to Better Service"** is a handy reference book, conveniently arranged to enable you to find at a glance, Valves and Engineering Appliances for any service. **A copy of this interesting book is yours for the asking. No obligation. Just fill in and mail coupon.**

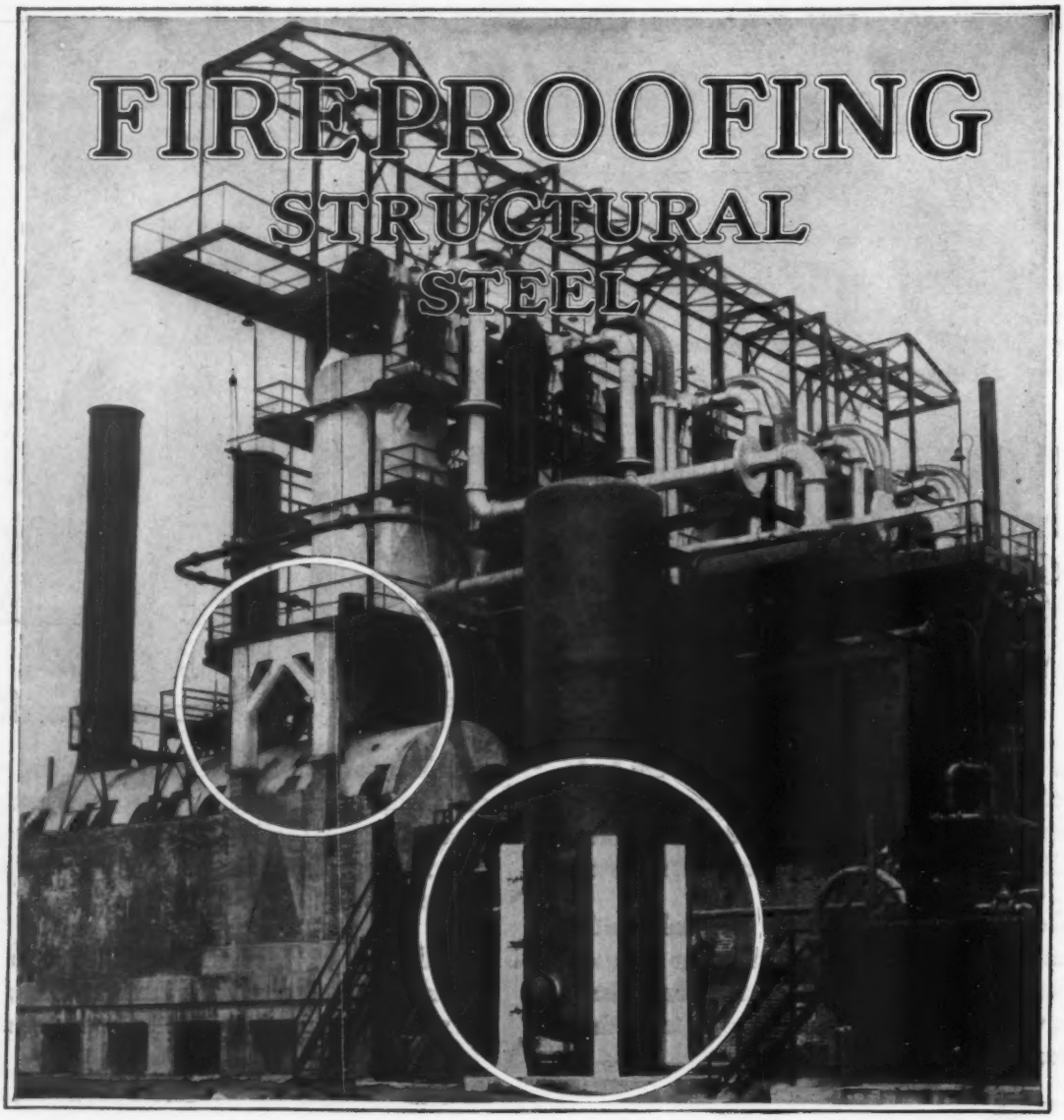


THE LUNKENHEIMER CO.
"QUALITY"
CINCINNATI, OHIO, U.S.A.
NEW YORK CHICAGO BOSTON PITTSBURGH
SAN FRANCISCO NEW ORLEANS
LONDON
EXPORT DEPT. 129-135 LAFAYETTE ST. NEW YORK

THE LUNKENHEIMER CO.
P. O. Box 876, Cincinnati, Ohio
Please send me, without obligation, copy of "Guide to Better Service," No. H1.
Name _____
Firm _____
Position _____
Address _____

5-28A-89

Mention Where You Saw the Advertisement



Johns-Manville Fireproofing. Note supporting legs of tank in foreground, knee braces and girders of tower supports, and supporting members of partial condensers above towers.

JOHNS-MANVILLE Fireproofing for structural steel has proven its value under the most severe conditions. Overhead apparatus, which would surely have collapsed due to weakening of steel supports, has, by this treatment, been preserved through fires that would otherwise have meant complete destruction. Use it also to insure the continued operation of remote control valve rods which might otherwise be disabled by flame.

JOHNS-MANVILLE CORP., 292 Madison Ave., at 41st St., New York City
Branches in all large cities For Canada: Canadian Johns-Manville Co., Ltd., Toronto

Through Asbestos and its allied products
INSULATION
BRAKE LININGS
ROOFINGS
PACKINGS
CEMENTS
FIRE PREVENTION PRODUCTS

JOHNS-MANVILLE

Oil Industry Department

Mention Where You Saw the Advertisement

Haul or skid this machine straight to the pipe, instead of hauling tons of pipe to a stationary straightener. With it, two men can straighten as much pipe as with a power machine, and do a better job! Sold subject to return if not entirely satisfactory.

WEIGHT
1275 pounds

POWER
hand

PRESSURE
30,000 pounds

CAPACITY
8″ pipe & smaller

This machine is entirely self-contained and is ready to go to work wherever you place it. Can be skidded, or hauled on wagon or ton truck.

PRICE
$350.00
f. o. b.
Burkburnett,
Texas

75 *straightened* joints pay for it

Under average conditions, the cost of having 75 joints of 6″ or 8″ pipe straightened will entirely pay for a W-K-M Portable Hydraulic Pipe Straightening Machine. From then on, the machine will pay for itself time after time. One major oil company, at an Arkansas warehouse, states that its men in one year increased the inventory value of pipe on hand by $70,000 with a W-K-M Straightener. Name on request. The coupon opposite will bring you full details of this machine—and how you can put it to coining money for you by straightening bent pipe and tubing at ridiculously low cost. Send it today, there is no obligation.

W-K-M COMPANY, Inc.
West Building, Houston, Texas.

Gentlemen:—

Without obligation, I would like to know more about your Portable Hydraulic Pipe Straightening Machine.

Name . . . . . .

Address . . . . . .

Mention Where You Saw the Advertisement

PRODUCERS & REFINERS CORP'N, WEST TULSA

The illustration above shows the Marley Spray Pond installation just recently installed for the above refinery. This Spray Pond is used to cool the hot water that comes from the condensor boxes. This Marley System will effect the user a material saving in their monthly water bill.

SPRAY POND ENGINEERS to the OIL INDUSTRY

EXPERT Marley Spray Pond Engineers are more ably equipped to counsel and advise with refineries on their Spray Pond Equipment. For, during the last several years most of the major Spray Ponds installations in the Southwest have been Marley installed. This experience therefore gives our engineers a wide knowledge of refinery needs and enable them to give you what you want, how you want it.

Greatest Efficiency, Lowest Pressure, Less Clogging

Then again too—you secure other valuable advantages in Marley Installations. For instance, you receive the Marley Spray Nozzle—the nozzle which provides a fine uniform spray at low operating pressure—with practically no clogging. You also receive the benefit of the latest improved Spray Group Fittings—and Spray Group Arrangement. Why not let us send you our catalog without obligation.

POWER PLANT EQUIPMENT CO.
Coca Cola Bldg. Kansas City, Mo.

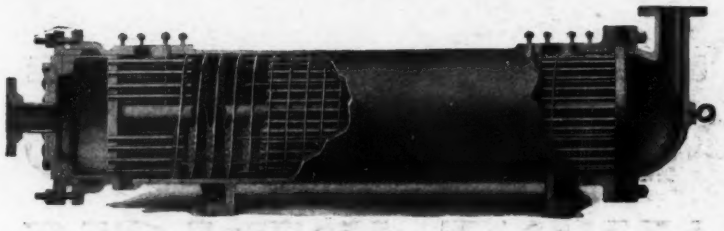
MARLEY PPE PRODUCTS

MARLEY

SPRAY PONDS SPRAY NOZZLES

Mention Where You Saw the Advertisement

Uses any raw water supply to cool engine jacket water



The G-R Multiwhirl Jacket Water Cooler

By eliminating the possibility of scale formation in the engine jackets will increase the operating efficiency and reduce the maintenance charges of oil and gas engines and compressors by preventing overheating troubles and assuring proper cylinder cooling effect.

With the G-R Multiwhirl Jacket Water Cooler a small amount of distilled water can be circulated continuously through the engine jackets and cooled by any kind of raw water in passing through the cooler. The unit is compact because of its high rate of heat transfer, is easily inspected and cleaned, and has several special advantages of construction that assure durability and trouble-free operation. Thousands are in service in every type of liquid cooling service.

Send the Coupon for Complete Information

THE GRISCOM-RUSSELL COMPANY
Dept. K, 285 Madison Avenue, New York

Philadelphia	Chicago	St. Louis	San Francisco
Boston	Cleveland	Kansas City	Los Angeles
Rochester	Detroit	Charlotte	Seattle
Pittsburgh	Milwaukee	New Orleans	Denver
Columbus	Minneapolis	Houston	Salt Lake City
Atlanta	Indianapolis	Dallas	Tulsa

For Canada: Riley Engineering and Supply Co., Ltd., Toronto

Griscom-Russell
Heat Transfer Apparatus

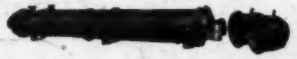
Note these other G-R Units for lower refining costs

G-R Sectional Condenser
For condensing hydrocarbon vapors and other vapors
Can be used either as a standard or reflux condenser. The sectional arrangement permits using as a condenser and heat exchanger in one set or to obtain a different cut from each section.

G-R Mineral Seal Oil Heat Exchangers
A compact, twin exchanger with strict counter-current flow to promote maximum rate of heat interchange.

G-R Vaneflo Gas Cooler
for cooling casinghead or natural gas. Can be used as inter-, after-, or precooler in absorption and compression type natural gasoline plants. Has low pressure loss and exceptional efficiency.

G-R Gasoline Condenser
for condensing natural gasoline vapors in casinghead gasoline plants. Can also be used as a knockout box or fractionating tower control section with particularly close control of the end points.



G-R Twin Heat Exchanger
for the efficient interchange of heat between crude oil feed stock and still bottoms, cold water and hot oil, feed stock and hot still vapors, etc.

The Griscom-Russell Company.
Dept. K, 285 Madison Ave.,
New York.

Please send information on

- ☐ Jacket Water Cooler
- ☐ Sectional Condenser
- ☐ Mineral Seal Oil Heat Exchanger
- ☐ Vaneflo Gas Cooler
- ☐ Gasoline Condenser
- ☐ Twin Heat Exchanger

Name .....

Address .....

R 2-27

. . . . . a product of local manufacture dependably serving local refiners and affording economies of local freight rates . . . . . that's

TEXAS FIRE BRICK

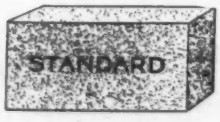
Texas Fire Brick fully meets the requirements of baffle brick, bridge walls, cracking stills, shell stills and boilers operating under normal heat ratings. As a local product conforming specifically to the needs of Southwestern Refiners Texas Fire Brick combines decided transportation economies with utmost quality efficiency—it costs less and serves better.

Elgin Butler Brick Co.,
Austin, Texas

Quality equal to more than 85% fire brick uses

Athens Brick & Tile Co.,
Athens, Texas

Texas Clay Products Co.,
Malakoff, Texas



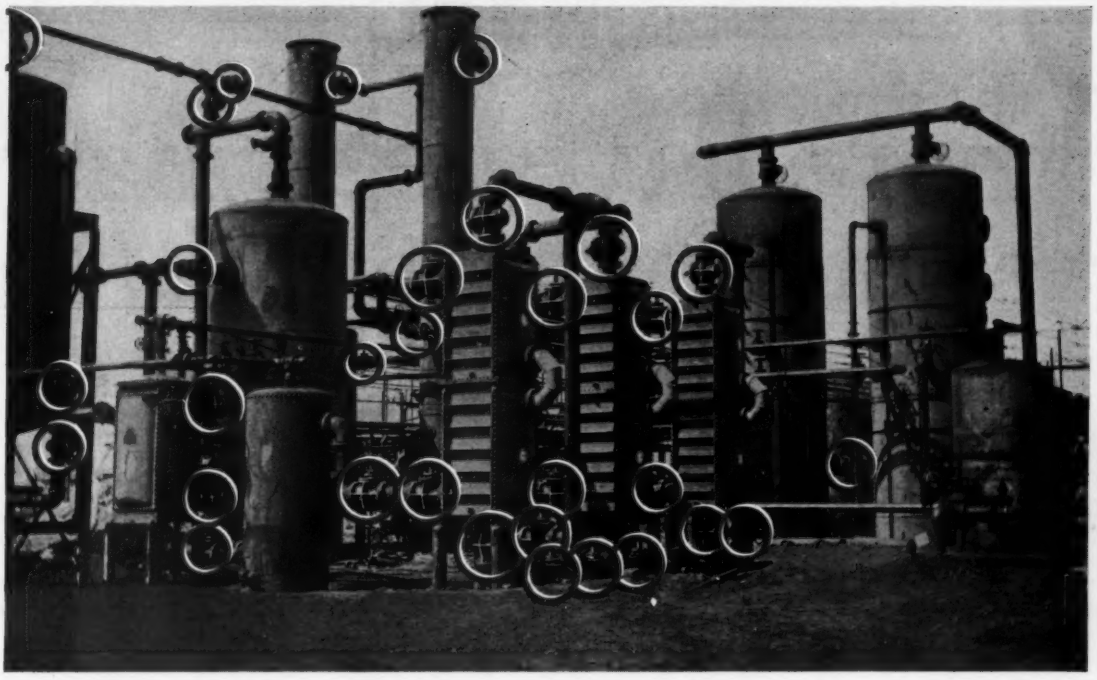
Acme Brick Co.,
Ft. Worth, Texas

For facts and figures write any Association Member listed.

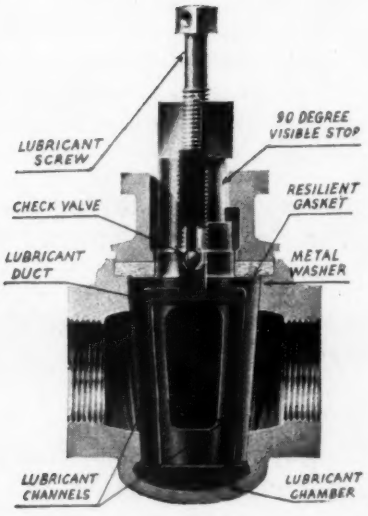
Texas Fire Brick Manufacturers' Association

Promoting Fire Brick Economies in Texas

Mention Where You Saw the Advertisement



No Valve Leaks in This Plant



THE modern gasoline plant dares not tolerate leaks or inefficient operation of valves. Pictured above is an installation in a natural gasoline plant, indicating locations of Merco Nordstrom Plug Valves. These valves operate under high and low pressures, and in varying temperatures. They are giving eminently satisfactory service under the most difficult conditions.

You can adapt Merco Nordstrom Plug Valves to your service everywhere in your plant where valves are required. We manufacture these valves in all required sizes with two, three and four-way openings and in different types of metal to meet your particular conditions. Request our new catalog.

MERCO NORDSTROM VALVE COMPANY

SUBSIDIARY OF THE MERRILL COMPANY

Engineers— MERCO *Manufacturers*

San Francisco 121 Second Street · New York 110 W. 40th Street · Chicago Peoples Gas Building · Houston 613 Washington Avenue · Cleveland 325 Engineers Building · *Agencies in Principal Cities*

Merco Nordstrom PLUG VALVES

Mention Where You Saw the Advertisement

SUNOCO

There have been many resolutions made *and broken* for 1927

But—

this one resolution has been unanimously adopted by the Natural Gasoline Plant Operators:

Resolved:

To give my plant highest operating efficiency throughout the entire new year by use of Sunoco Absorption Oils 630 and 670.

Two grades, manufactured for your particular design of Natural Gasoline Plant.

Samples and quotations furnished on request.

Better fractionation
Higher operating efficiency
Greater heat transfer
Increased yields

Samples and quotations furnished on request

SUN COMPANY

Petroleum Bldg., Tulsa, Oklahoma

Refineries at

Marcus Hook, Pa. Yale, Oklahoma Toledo, Ohio

Bad Flanges hurt profits

WHETHER you have ever noticed the fact or not — flanges have a very definite effect on your balance sheet. The wrong kind of flanges makes leaks an ever-present danger. And pipe-line leaks, however small, threaten damage to materials and finished stock—power wastes—expensive shut-downs.

But Pennsylvania Forge Flanges insure joints that stay sealed. Bolts pulled up tight in the first place — because the fitter knows he need not fear breaking a Pennsylvania Forge Flange. And they withstand every shock or strain from temperature fluctuations, internal pressure, expansion and contraction, water hammer, or vibration. Ductile as the pipe itself. Tensile strength 60,000 lbs.; elastic limit, 30,000 lbs. Flawless machining and threads.

Flanges of Special Metals

For Chemical lines, or other special uses, Pennsylvania Forge Flanges can be had in Stainless Steel, Monel metal, nickel, copper, or whatever alloy may be required.

Let us send you this book

Contains a mass of authoritative data pertaining to pipe lines. Your name on a postcard brings it—free.

No better flanges!

No better service!

PENNSYLVANIA FORGE COMPANY

PHILADELPHIA

Stocks carried at most branches

San Francisco:
Chas. L. James, 525 Market Street

Los Angeles, Cal.:
John G. Bell Co., 923 Sante Fe Ave.

St. Louis, Mo.:
W. R. Maxwell, 915 Olive St.

Phila., Pa.:
Ford & Kendig Co., 1428 Callowhill St.

Boston, Mass.:
E. B. Badger & Son Co., 75 Pitts St.

Tulsa, Okla.:
A. J. McEwan, 1704 S. Utica St.

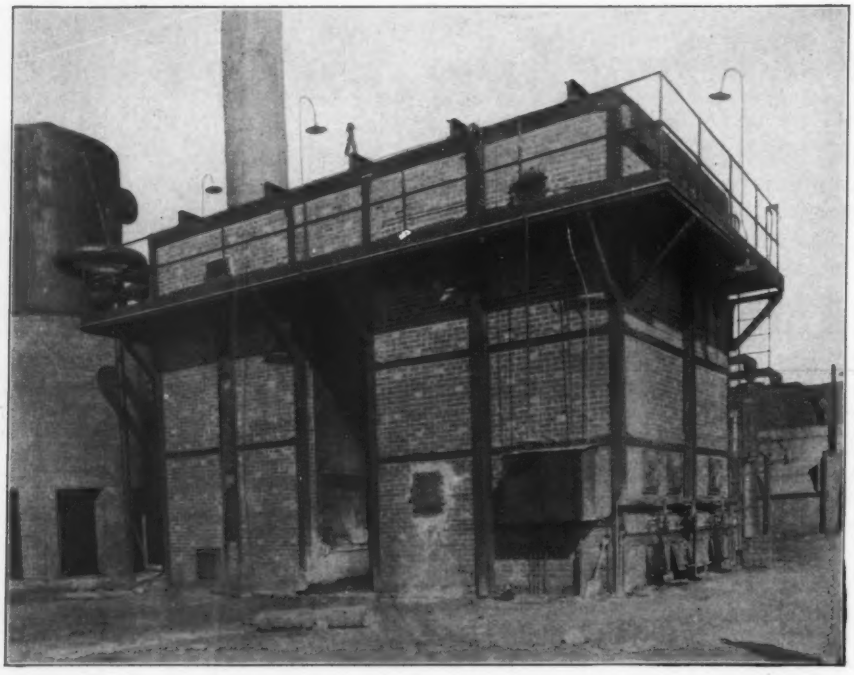
The strength of the line is only the strength of the Flanges

PENN FORGE FLANGES

Mention Where You Saw the Advertisement

FOSTER

TUBE STILLS



OVER 500 Foster Tube Stills are operating with a high degree of efficiency in topping crude oil, re-running distillates, recovering light oils, continuous distillation, distilling crude coal tar, cracking, producing lubricating stock, preheating, cooling oil vapor, heating asphalt, refining vegetable oils, and many other industrial oil heating operations.

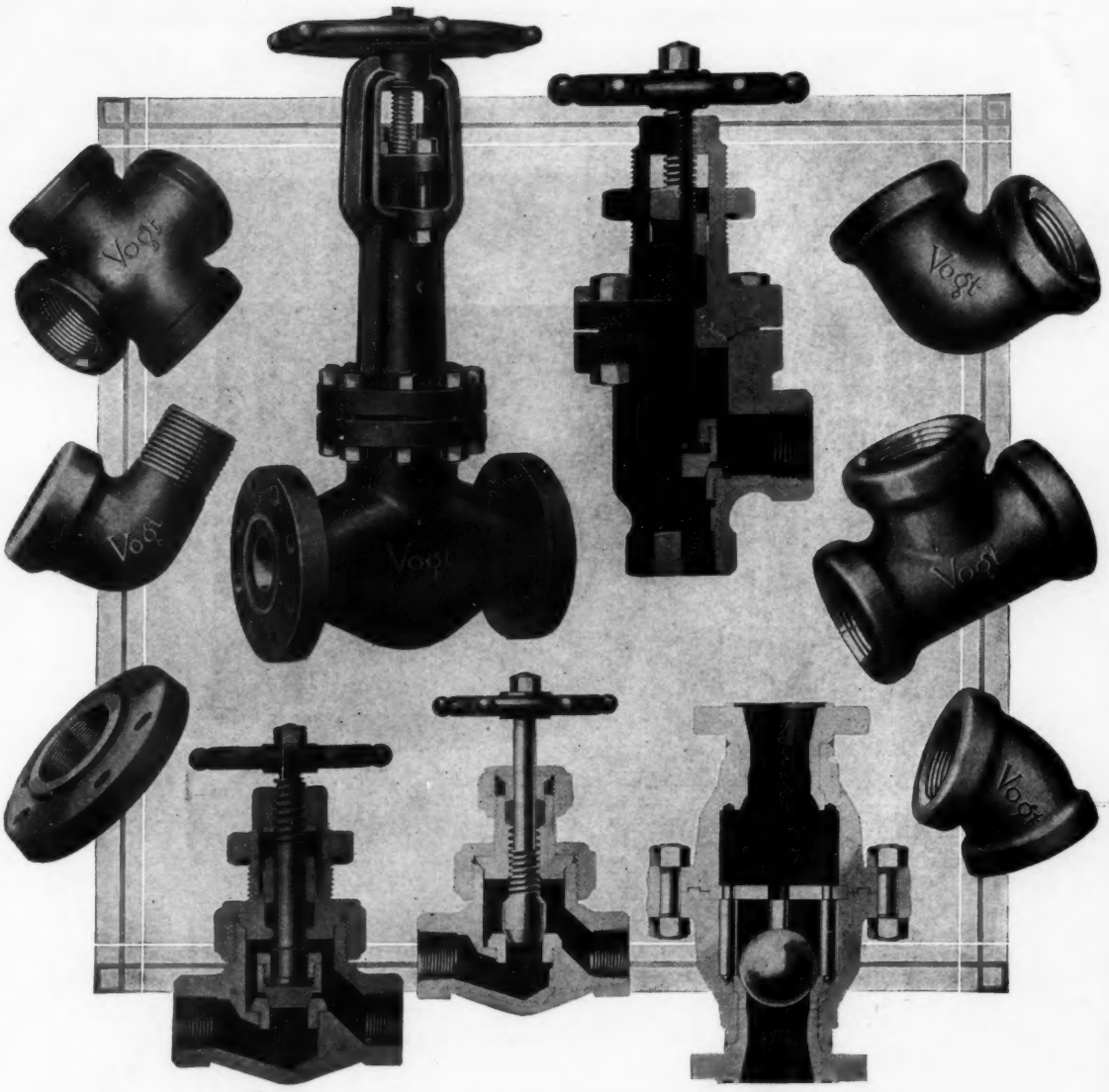
Write for special bulletin on tube stills

POWER SPECIALTY COMPANY

111 BROADWAY, NEW YORK

Branches in All Oil Centers

Mention Where You Saw the Advertisement



~Announcement~

ALL sizes of Vogt Drop Forged Steel Fittings can now be furnished forged completely of stainless steel. All sizes of Vogt open hearth forged steel valves can be furnished with stainless steel trimmings, and hardened seats and discs.

Write for prices and further information

HENRY VOGT MACHINE CO.
INCORPORATED
LOUISVILLE, KY.

New York Chicago Philadelphia Cleveland Dallas

Manufacturers of: OIL REFINERY EQUIPMENT, DROP FORGED STEEL VALVES AND FITTINGS, WATER TUBE AND HORIZONTAL RETURN TUBULAR BOILERS, ICE MAKING AND REFRIGERATING MACHINERY.

The Holmes-Manley *Cracking* Process

Low operating temperatures and a dependable scraping device prevent excessive coke formation. This insures a high operating ratio . . . .

The Licensee receives:—

1. *A Proven Process*
2. *Complete Technical Service*
3. *The Benefit of Future Developments*

Licenses Granted by

THE TEXAS COMPANY, U. S. A.

Apply to

W. S. S. RODGERS

17 Battery Place, New York, N. Y.

Mention Where You Saw the Advertisement

PITTSBURGH SEAMLESS

The Achievement of Specialists

THE dependable uniformity of the chemical and physical properties of "Pittsburgh Seamless" Tubes is the result of more than twenty years of experience devoted EXCLUSIVELY to the manufacture of seamless steel tubes.

"Pittsburgh Seamless" Boiler Tubes and Still Tubing

fully measure up to the exacting requirements of oil refining equipment. They have great strength and elastic limit, are easily installed and mean lower tube costs per year.

The same high quality and standard of manufacture are also available in "Pittsburgh Seamless" steel casing, tubing and drill pipe. Write for our booklet "Seamless Steel Tubes for Oil Country Purposes," mailed free upon request.

Pittsburgh Steel Products Company

PITTSBURGH NEW YORK DETROIT CHICAGO

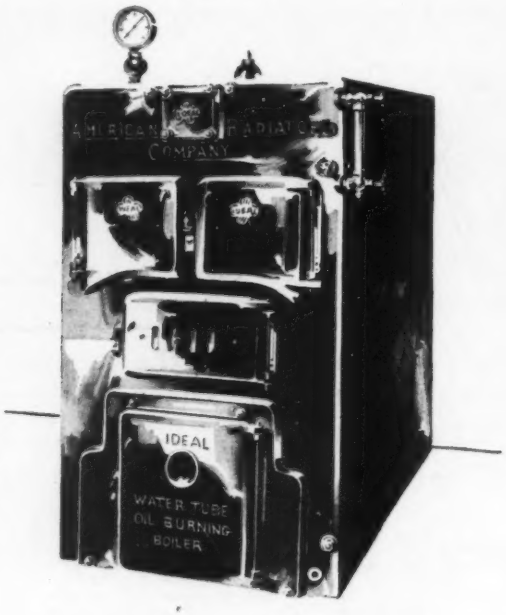
Second National Bank Building HOUSTON, TEXAS

Atlas Life Building TULSA, OKLA.

Test Pieces

IDEAL *Water Tube*
Oil Burning Boiler

For homes, apartment buildings, sky-scrapers,— the IDEAL Water Tube Oil Burning Boiler is of such range and capacity that it will fulfill the most exacting requirements and will function with full efficiency during the life of any building. It is especially designed for rapid heating.



Best Oil Burner Results

In keeping with its larger ideals of public service and the obligations of leadership, American Radiator Company, from the first, have kept open the doors of its great laboratories for the aid of oil burner inventors and manufacturers.

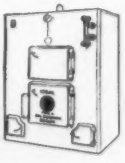
This close and continuous cooperation has resulted in the practical scientific development of modern oil burners, and the perfection of IDEAL Boilers for oil burning.

Here again, with its wealth of heating experience and its vast equipment in heat-measuring, heat-recording, and heat controlling facilities, American Radiator Company has demonstrated that it is truly a WORLD INSTITUTE OF HEATING.

IDEAL Boilers, for oil burning, are offered in three types,—scientifically proportioned and equipped to guarantee the utmost in oil burner results. These IDEAL Boilers have had their complete development hand in hand with the oil burner industry and they afford, therefore, the best to be obtained in operating efficiency, economy, and dependability.

ARCO ROUND *Oil Burning Boiler*

The most widely used heater for homes,—the ARCO Round Oil Burning Boiler is designed and constructed for efficient oil burning. It delivers satisfactory results in daily service, during the life of the building.



IDEAL *Type "A" Oil Burning Heat Machine*

Distinguished for its cleanliness and attractiveness, this boiler is the "aristocrat of home heating boilers." It is scientifically designed and constructed for efficient oil burning and is suitable, single or in batteries, for the finest residences and largest buildings.

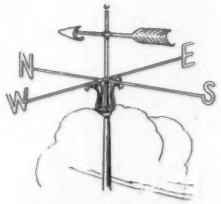
AMERICAN RADIATOR COMPANY

Showrooms and sales offices: New York, Boston, Providence, New Haven, Newark, Philadelphia, Baltimore, Washington, Richmond, Buffalo, Pittsburgh, Cleveland, Detroit, Cincinnati, Atlanta, Chicago, Milwaukee, Omaha, Indianapolis, St. Louis, St. Paul, Minneapolis, Denver, Kansas City, San Francisco, Los Angeles, Seattle, Toronto, London, Paris, Milan, Brussels, Berlin

Makers of IDEAL Boilers for coal, coke, oil and gas. AMERICAN Radiators, ARCO Hot Water Supply Heaters, VENTO (Ventilating) Heaters, Heat-Controlling Accessories and other products for drying, humidifying, cooling and refrigeration.

NOTE: ***The above advertisement is being run in the March issue of leading family magazines embracing a total circulation of over 10,000,000 copies. This is our contribution to the advancement of the oil industry.***

Wheeler Partial Condenser.



The Weather

is an undependable superintendent

THE quality of your product depends upon the temperatures in the deflegmators and reflux condensers. Gasoline is universally purchased on an end-point basis. If the temperature of the reflux condenser is too high, an undesirable amount of heavy vapors will pass to the final condensers and the gasoline will require re-distillation. If the temperature is too low, part of the gasoline is returned to the stills or added to the kerosene fraction. The action of air-cooled reflux condensers varies with the weather. On the other hand, the temperature of the reflux and of the vapors may be regulated automatically within a few degrees with water or oil-cooled reflux condensers. If the crude oil is used in the partial condenser it becomes a heat exchanger and a part of the heat in the vapors is returned to the stills. Write the Wheeler Condenser & Engineering Company for further information.

WHEELER
Oil Refinery Equipment

HEAT EXCHANGERS
(Liquid to Liquid)
VAPOR HEAT EXCHANGERS
FINAL CONDENSERS,
VACUUM CONDENSERS,
PARTIAL CONDENSERS
THERMO COMPRESSORS.

Other Products Include:

Cooling Towers,
Surface Condensers,
Steam Jet Air Pumps,
Expansion Joints,
Heaters,
Evaporators,
Centrifugal Pumps,
Brass and Copper Tube and Pipe

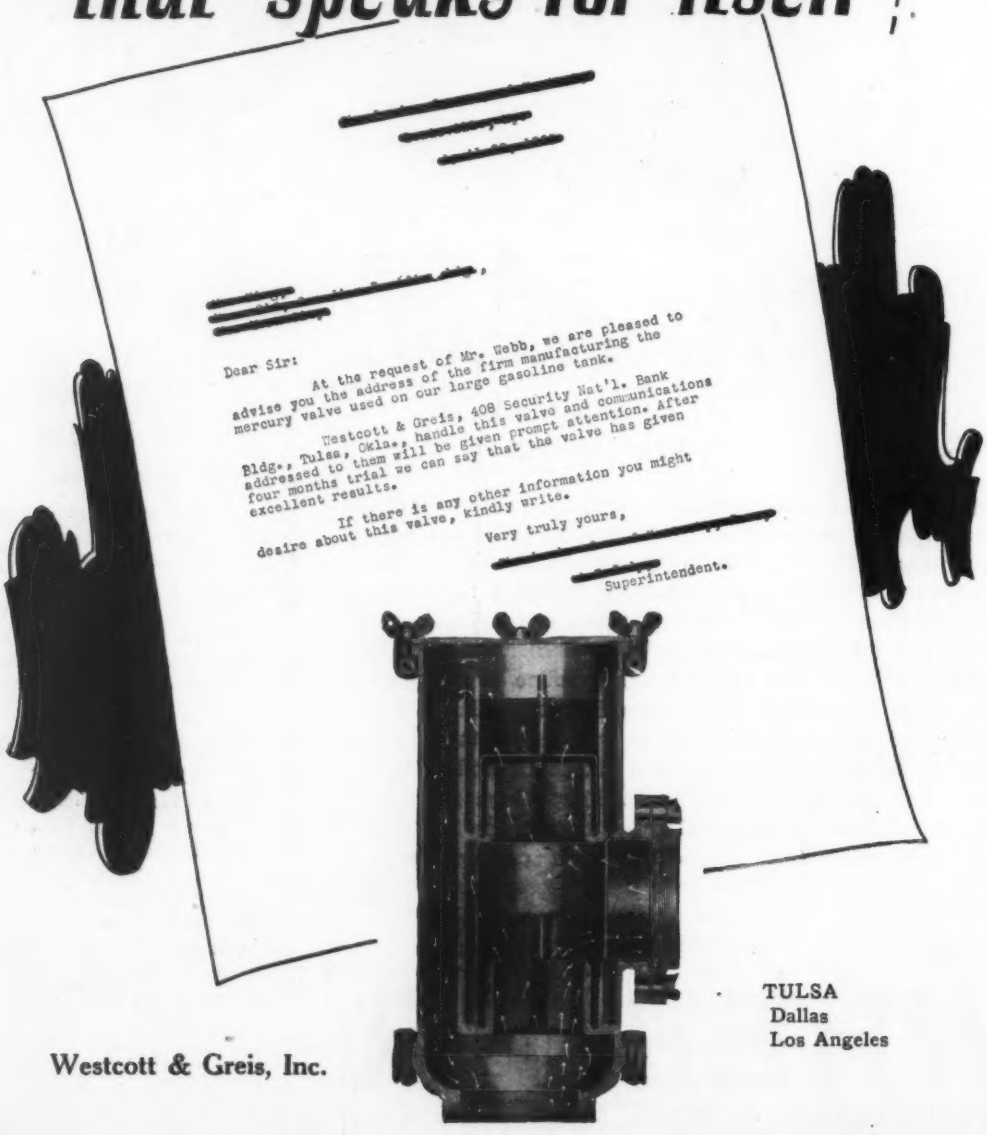
LOCAL OFFICES:

Birmingham
Boston
Chicago
Cincinnati
Cleveland
Dallas
Denver
Havana
Kansas City, Mo.
Los Angeles
New Orleans
Philadelphia
Phoenix
Pittsburgh
Portland, Ore.
Salt Lake City
Seattle
San Francisco
Vancouver

WHEELER
CONDENSER & ENGINEERING CO.
Works, CARTERET, N.J.
and NEWBURGH, N.Y.
Main Office—149 Broadway, New York City

72

A Recommendation that speaks for itself!

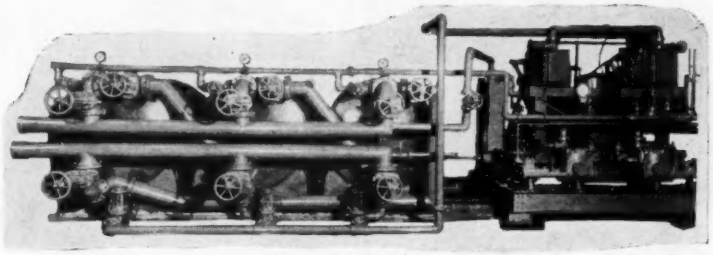

Dear Sir:
At the request of Mr. Webb, we are pleased to advise you the address of the firm manufacturing the mercury valve used on our large gasoline tank.
Westcott & Greis, 408 Security Nat'l. Bank Bldg., Tulsa, Okla., handle this valve and communications addressed to them will be given prompt attention. After four months trial we can say that the valve has given excellent results.
If there is any other information you might desire about this valve, kindly write.
Very truly yours,
Superintendent.

Westcott & Greis, Inc.

TULSA
Dallas
Los Angeles

WESTCOTT & GREIS

Mention Where You Saw the Advertisement



The Charcoal Process offers you plants of greatest portability and salvage value.

Portable and larger sized shop-built plants in stock.

GASOLINE RECOVERY CORPORATION
Charleston, W. Va.

TULSA
427 Wright Bldg.

LONG BEACH
Box 321

CHARCOAL PROCESS

Of Gasoline Recovery

"A fine Group of Tanks—*but why don't you* Protect them?"

WE offer the oil industry the most advanced, safest and surest protection against fire and evaporation —*Oceco Equipment*—an outstanding achievement in this field—*equipment with a service record!*

For complete information address "Headquarters" or any of the branches or representatives here listed.

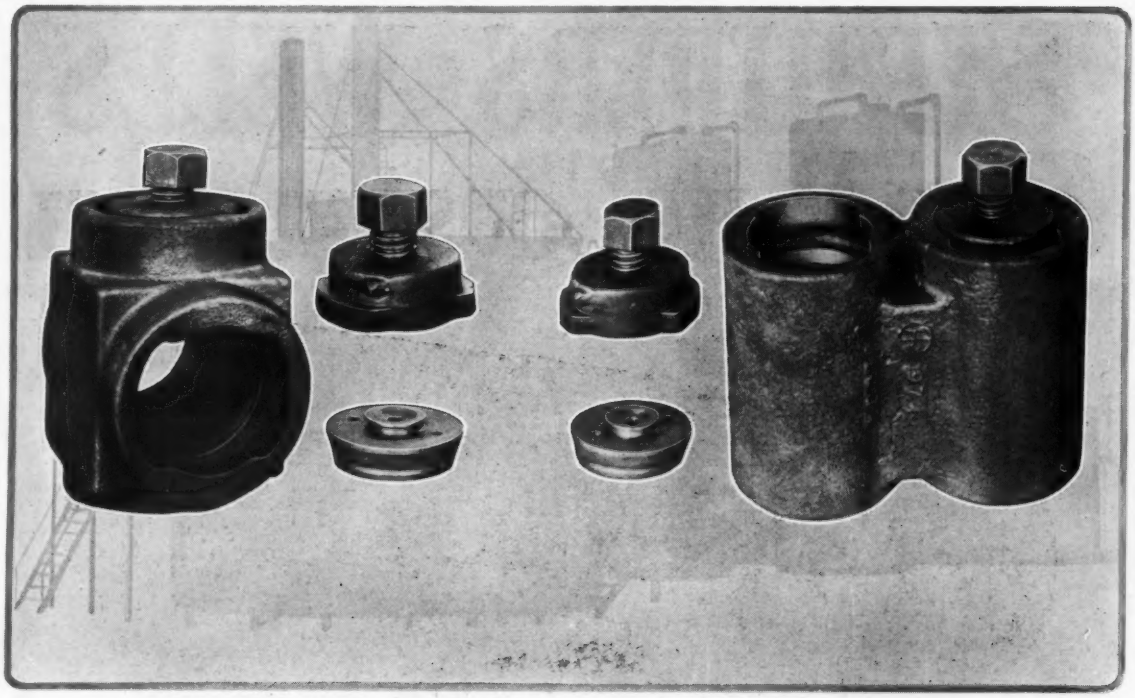
THE OIL CONSERVATION ENGINEERING COMPANY
877 Addison Rd. *Headquarters for Tank Equipment* Cleveland, O.

ENGINEERING AND SALES SERVICE AT—

25 Broadway, New York
417½ Boulder St., Tulsa, Okla.
O-S Building, Casper, Wyo.
Neilan, Schumacher & Co., Los Angeles, Calif.
Box 552, Beaumont, Texas

OIL TANK **OCECO** EQUIPMENT
SAVES EVAPORATION AND PREVENTS FIRE

Mention Where You Saw the Advertisement



The *New Ohiolock Plug*

The new "Ohiolock" plug, a more efficient and economical closure, cuts to a minimum the time required to close down your stills and clean out the tubes.

Simplicity and ease of operation make it quicker in action. Its positive lock means pressure insurance to you. Bothersome threads which leak, corrode, and stick are eliminated.

A quarter turn of the plug locks it in position, turning up the set screw completes the job. Once in place, no more attention is required. It is there to stay until you are ready to take it out. The removal is just as simple as the application.

Its greater strength is readily seen and the quick and positive action takes full advantage of this strength. Locked in position, dangerous and expensive leaks are eliminated. It cannot loosen up in service.

Hi-Steel return bends with "Ohiolock" plugs, take care of your pressure problems. They will meet any pressure of temperature conditions.

Let us show you how "Ohiolock" can help you.

The Ohio Steel Foundry Co.

Springfield, Ohio

SALES OFFICES:
HOUSTON—HARRISBURG PIPE & PIPE BENDING CO., OF TEXAS
CHICAGO—PEOPLES GAS BLDG.
NEW YORK—76 WEST ST.
PHILADELPHIA—22 SO. 18TH ST.
LOS ANGELES—4920 LOMA VISTA AVE.

PLANTS IN
SPRINGFIELD
LIMA

Mention Where You Saw the Advertisement

"A fine Group of Tanks-but why don't you" Protect them?

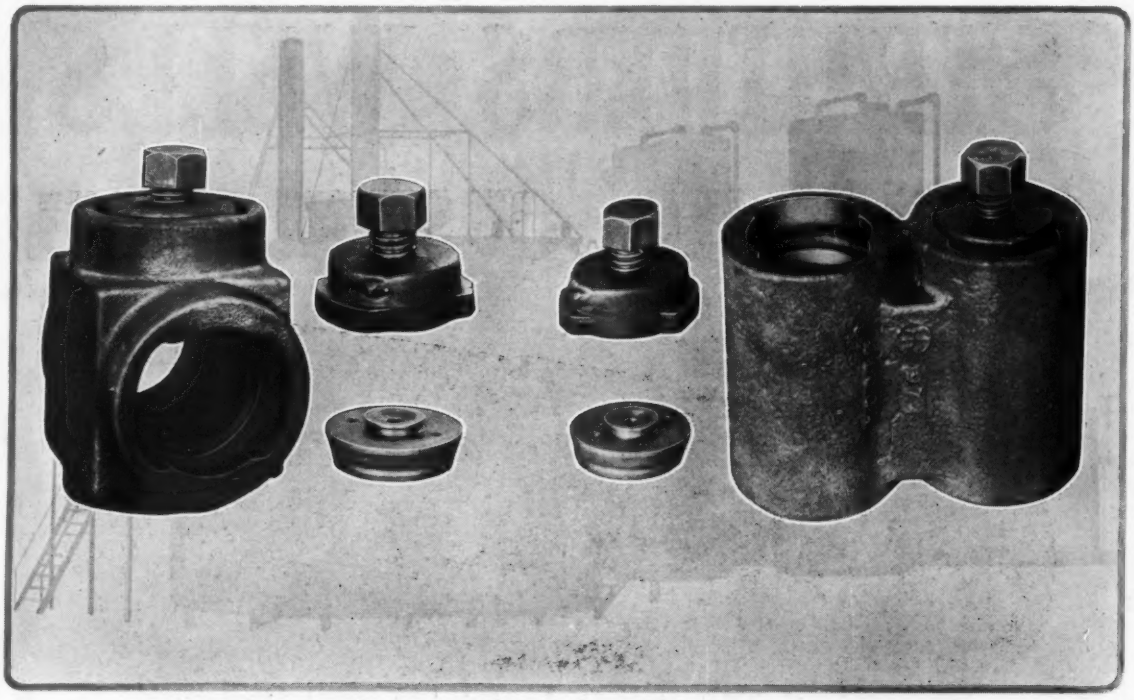
WE offer the oil industry the most advanced, safest and surest protection against fire and evaporation —*Oceco Equipment*—an outstanding achievement in this field—*equipment with a service record!*

For complete information address "Headquarters" or any of the branches or representatives here listed.

THE OIL CONSERVATION ENGINEERING COMPANY
877 Addison Rd. *Headquarters for Tank Equipment* Cleveland, O.
ENGINEERING AND SALES SERVICE AT—
25 Broadway, New York
417½ Boulder St., Tulsa, Okla.
O-S Building, Casper, Wyo.
Neilan, Schumacher & Co., Los Angeles, Calif.
Box 552, Beaumont, Texas

OIL TANK **OCECO** EQUIPMENT
SAVES EVAPORATION AND PREVENTS FIRE

Mention Where You Saw the Advertisement



The *New Ohiolock Plug*

The new "Ohiolock" plug, a more efficient and economical closure, cuts to a minimum the time required to close down your stills and clean out the tubes.

Simplicity and ease of operation make it quicker in action. Its positive lock means pressure insurance to you. Bothersome threads which leak, corrode, and stick are eliminated.

A quarter turn of the plug locks it in position, turning up the set screw completes the job. Once in place, no more attention is required. It is there to stay until you are ready to take it out. The removal is just as simple as the application.

Its greater strength is readily seen and the quick and positive action takes full advantage of this strength. Locked in position, dangerous and expensive leaks are eliminated. It cannot loosen up in service.

Hi-Steel return bends with "Ohiolock" plugs, take care of your pressure problems. They will meet any pressure of temperature conditions.

Let us show you how "Ohiolock" can help you.

The Ohio Steel Foundry Co.

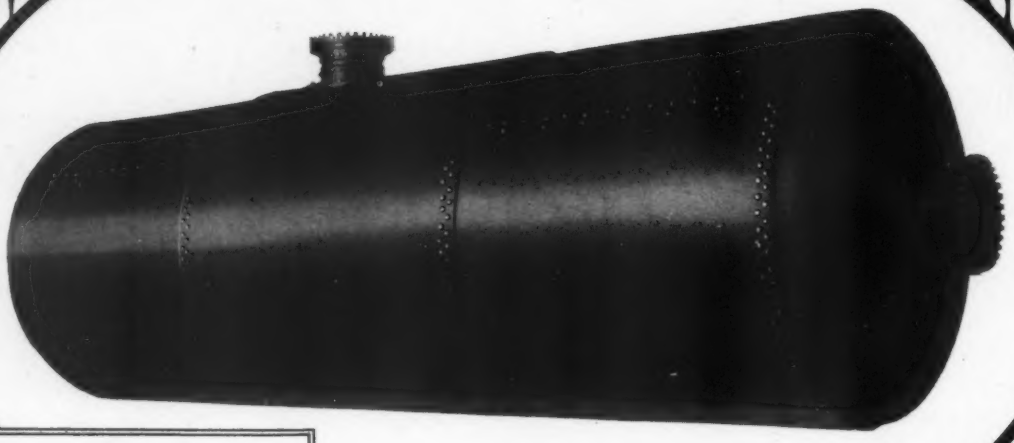
Springfield, Ohio

SALES OFFICES:
HOUSTON—HARRISBURG PIPE & PIPE BENDING CO., OF TEXAS
CHICAGO—PEOPLES GAS BLDG.
NEW YORK—76 WEST ST.
PHILADELPHIA—22 SO. 16TH ST.
LOS ANGELES—4920 LOMA VISTA AVE.

PLANTS IN
SPRINGFIELD
LIMA

Mention Where You Saw the Advertisement

STRUTHERS-WELLS Steel Plate Construction



Special Type High Pressure Cracking Still of Struthers-Wells construction — made for large Mid-Continent refiner.

257 of These Stills Now in Use

Six years ago one of the largest Mid-Continent refiners placed an order with us for a special type still, as shown in the illustration. Since that time, orders for 257 of these stills have been received and you will find them giving the very best of service in all the large refineries of this company.

That surely is significant evidence of the dependability and satisfaction of Struthers-Wells products.

Operating the largest electric welding plant in the country it is possible for us to manufacture pressure and vacuum stills of welded or riveted construction. Send us your specifications.

FOUNDERS—MACHINISTS
BUILDERS OF SPECIAL MACHINERY

STRUTHERS-WELLS PRODUCTS FOR REFINERIES

Bubble Towers
Heat Exchangers
Dephlegmators
Condensers
Distillate Separators
Grease Mixing Kettles

STRUTHERS-WELLS CO

WARREN, PENNA.

MANUFACTURERS — ENGINEERS

Steel Plate Construction

CHEMICAL — REFINING — RUBBER

Branch offices in principal cities

Seventy-Five Years of Accumulated Experience at your Service.

"Anything in Steel Plate construction of Stainless Steel."

We Sincerely Believe That a Refinery Equipped With

Kellogg pipe stills

Kellogg-Alcorn radiant heat furnace with Carborundum boxes

Kellogg fractionating towers

Cross cracking units, and

Gray Vapor Phase Treating Towers

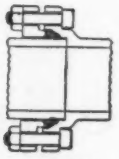
will yield the greatest returns from any type of crude.

THE W. M. KELLOGG CO.

7 Dey Street, New York City

Branch Offices:
700 Baltimore Ave., Kansas City, Mo.
444 Market St., San Francisco, Calif.
1019 Hellman Bank Bldg., Los Angeles, Calif.

SIMPLEX CAST IRON CONDENSER PIPING



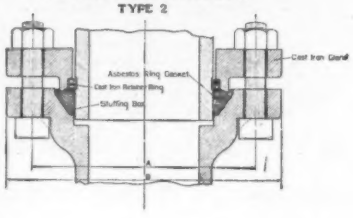
"ONE FLANGE IS LOOSE"

Settles the Rust Question

Progressive refineries now secure the durability of cast iron pipe in their condenser coils without the disadvantage of standard flanged pipe construction. Our Simplex joint, using a triangular shaped, endless asbestos gasket, is the secret. It is fully described and illustrated in our Catalog No. 55. Your copy is ready to be mailed upon receipt of your request.

Do you know why cast iron resists corrosion so much more than other ferrous metals? Our Bulletin No. 44 explains it.

CROSS SECTION OF ASSEMBLED JOINT
SIMPLEX CONDENSER PIPING
TYPE 2



Dimensions A and B are American Standard for 125 lbs. pressure

AREA PER LINEAR FOOT

SIZE	CLASS	INSIDE SQ.FT.	OUTSIDE SQ.FT.
3	AB	.07854	.10171
3	CD	"	.10472
4	A	.12672	.13490
4	B,C,D	"	.13100
6	A	.13708	.18650
6	B,C,D	"	.18326
8	AB	.32944	.33600
8	CD	"	.34440
10	AB	.36890	.37190
10	CD	"	.37900
12	AB	.51618	.54800
12	CD	"	.55600

Write for Simplex Condenser Catalog Number 55

AMERICAN CAST IRON PIPE COMPANY

General Offices and Foundry: Birmingham, Ala.

Branches at
Dallas, Kansas City, San Francisco, Los Angeles, Chicago, New York,

Write Also for information on Our Prepared Joint Cast Iron Pipe for Oil Lines

Midwest Joints *Simplify* Piping Erection

TWO pieces of 4-inch extra heavy wrought steel pipe provided with Midwest Joints were deliberately pulled up 1½ inches out of alignment, as shown in the photograph. The ends were capped with Midwest blind flanges and a hydrostatic pressure of 2000 pounds was applied. The valve between the pump and blind flange was closed, and the pressure maintained indefinitely, which indicated absolute tightness even though the piping was misaligned 3.8 degrees.

Simplify is really an inadequate word to describe how Midwest Joints influence the erection of piping upon which they are used. Because piping with Midwest Joints need not be in perfect alignment, less time is required for erection and the cost of this work is materially reduced. Additional savings result from the absence of gaskets and field welding. These savings are made every time the piping is taken down and replaced, when necessitated by cleaning. It is therefore obvious that less time is lost from plant operation.

There are other important reasons why refiners placed more than 15,000 Midwest Joints in service during 1926. We shall be glad to tell you about them.

Write for circular 0-2

MIDWEST PIPING & SUPPLY COMPANY

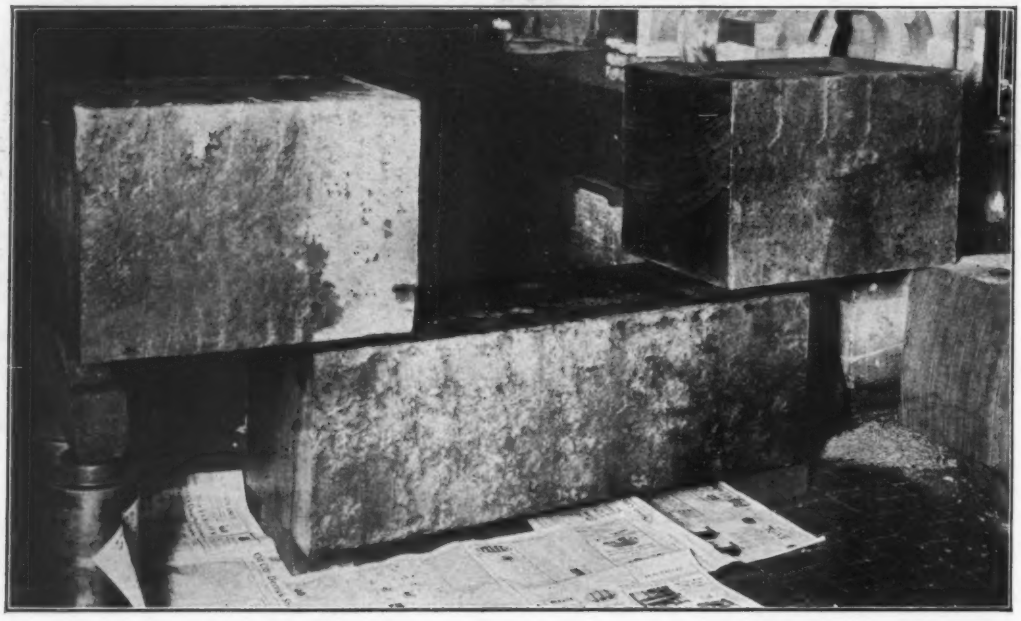
Second and Miller Sts.
SAINT LOUIS, MISSOURI

Tulsa Office: 805 Mayo Building **Chicago Office: 208 South La Salle St.**

Fabricators of Oil Refinery, Natural Gasoline Plant and Power Piping

MIDWEST GASKETLESS JOINTS

STRENGTH



TRANSIT
HOT OIL PUMPS

are nearly as strong as the forged steel billets from which they are made.

Might may not always be right, but strength is a great factor in safety.

TRANSIT Hot Oil Pumps have many features, but the greatest of these is safety.

We have just completed a description of three types of our Hot Oil Pumps, which we will be glad to send you on request

NATIONAL TRANSIT
Pump & Machine Company

Oil City, Pa.

New York Cleveland Philadelphia Pittsburgh
Denver Houston Tulsa

Mention Where You Saw the Advertisement

Vol. 6, No 2. FEBRUARY, 1927

The REFINER
AND NATURAL GASOLINE MANUFACTURER

Edited Monthly at Tulsa, Oklahoma GRADY TRIPLETT, *Editor*

TABLE OF CONTENTS

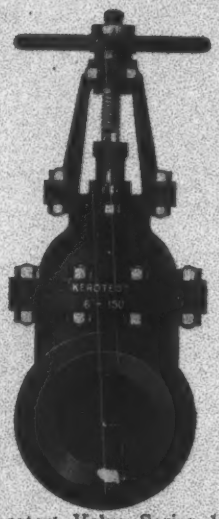
EDITORIAL COMMENT 47
By Grady Triplett
TREND OF CALIFORNIA ABSORPTION PRACTICE 49
By Paul Barton
CALIFORNIA ABSORPTION PLANT TAKES SMALL GROUND SPACE 50
By George Reid
ENGINEERS MEETING PROMISES MUCH TECHNICAL PROGRESS 52
ISOMETRIC MAPS MAKE A PICTURE OF REFINERY PIPING 53
CORROSION IN NATURAL GASOLINE MANUFACTURE 55
By R. W. Finney and H. W. Young
CHEMICAL CONTROL AT TREATING PLANT 57
By L. J. Catlin
CAUSTIC SODA DISSOLUTION MADE SAFE AND ECONOMICAL 59
By H. L. Kauffman
COOLING OF ABSORPTION OIL AT GASOLINE PLANTS 61
By E. R. Cox
OIL FROM COAL NOT NOW PRACTICAL, BUT POSSIBLE 63
By Ismar Ginsberg
INCREASING OUTPUT BY DECREASING EQUIPMENT 65
By George Reid
ELIMINATION OF PLANT LOSSES SUBJECT OF TECHNICAL MEETING 67
By Roye Munsell
CONSTRUCTION AND OPERATION OF BUBBLE CAP TOWERS 69
By Fred C. Koch
BURNING HEAVY RESIDUAL FUELS AT REFINERIES 72
By W. E. Perdew
FURNACE DESIGN LARGE FACTOR IN FUEL ECONOMY 76
By B. P. Lientz
PROGRESS OF FUEL ECONOMY CREDIT TO REFINERS 82
By John Thoen
BUREAU MAKES SURVEY OF PIPE LINES AND STORAGE CAPACITIES 88
By G. R. Hopkins and A. B. Coons
TOWER AFFECTS SAVING IN GASOLINE RECOVERY 94
By A. R. McTee
MANUFACTURERS AND SUPPLY DEALERS NOTES 100
RECENT REFINERY PATENTS 104
EXTRACTS OF REFINING TECHNOLOGY 116

Published Monthly by GULF PUBLISHING COMPANY, INC.
Copyrighted, 1927
R. L. DUDLEY, *President* A. L. BURNS, *General Manager*
Office of Publication: 1716 Dallas Avenue, Houston, Texas

NEW YORK: Room 832, 250 Park Avenue, R. P. Swinsky, Manager. *PITTSBURGH:* 2201 First National Bank Bldg., W. W. Pigue, Manager. *CHICAGO:* 476 First National Bank Bldg., O. R. Waller, Manager. *LOS ANGELES:* 1201 Haas Bldg., Wm. V. Gross, Manager. *TULSA:* 214-218 Atco Bldg., J. F. Carter, Jr., Manager. *FORT WORTH:* 203 W. T. Waggoner Bldg., H. H. King, Manager. Single Copies 20 cents. Domestic Subscription price, $1.00 a year. Foreign Subscription price $1.50 a year. Advertising rates upon application.

For Strong and Dependable Refinery Valves

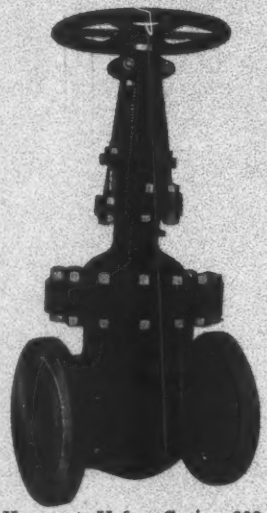
SPECIFY KEROTEST



Kerotest Valve Series 150

150 lbs. working pressure at 750° F.

250 lbs. working pressure at 100° F.



Kerotest Valve Series 300

300 lbs. working pressure at 750° F.

700 lbs. working pressure at 100° F.

—Six Standard Kerotest High Pressure Valves That Cover All Pressure and Temperature Requirements of Steam, Oil, Water and Gas.

1—Series 150	150 lbs. pressure at 750°
2—Series 250	250 lbs. pressure at 750°
3—Series 300	300 lbs. pressure at 750°
4—Series 400	400 lbs. pressure at 750°
5—Series 600	600 lbs. pressure at 750°
6—Series 900	900 lbs. pressure at 750°

Made of tough, close grained ilmenite electric steel—strong and dependable for valve service.

Trimmed in any special metal specified including:

Monel, Bronze, Nickel, Chrome Nickel, Stainless Steel, Carbon Steel, etc.

Complete technical information and recommendations, based on years of experience in high pressure line problems may be obtained upon request.

WRITE FOR THE KEROTEST FOLDER

Kerotest Manufacturing Company

2525 Liberty Avenue

PITTSBURGH PENNA.

Mention Where You Saw the Advertisement

EDITORIAL COMMENT

At It Again—

ONE of the regular and disastrous mysteries of the refining division of the petroleum industry is on the stage again. It comes along for an act about this time each year.

Most any refiner in the Mid-Continent area, if interviewed will admit that too much crude oil is being run through the stills of the district. Estimates vary as to the amount that is in excess of good judgment. Some say it is 40,000 barrels daily. That is the low figure. Some place it at 50,000 and others still higher.

That too much crude oil is being converted into gasoline in the Mid-Continent is a common opinion.

The mystery comes in that runs are not reduced. Similar situations have come in past years. But runs have not been reduced until a low market forced the lower throughput.

Gasoline is facing a weak market. If opinions are based on accurate calculations, Mid-Continent refinery runs should have been reduced December 1. January 1, found the greater Mid-Continent refineries running more crude than a year ago. Runs are still too high.

It is just one of those conditions, which each man knows should be changed and each man waits for the other. Perhaps it happens in other industries and can not be explained there.

* * * *

Differences All Alike—

IN the past year refiners have bought acres of newspaper space for telling the merits of their "new" gasolines. Each is heralded as something different and a few cannot be duplicated, according to printed claims.

But the peculiar part of the whole situation is that each refiner sets up a claim so alike that of all others that it becomes just one story, so far as the gasoline buyer is concerned.

The words of advertisements differ but each bit of copy is built on these three claims:

"No Knocking".
"More Power".
"Easier Starting".

There is no denying that gasoline specifications are changing. The product of today differs from that of a year ago. Doubtless refiners are offering a better product. One may excel others.

But the points of excellence are not to be told in newspaper advertising. The copy is all alike. If trademarks and company names were changed, one advertisement would serve a half dozen refineries.

What the refiners seem to need is some advertising copy that is as different as the gasoline is different.

* * * *

Refiners Meet at Kansas City—

KANSAS City has been selected by a vote of the members for the next convention city of the Western Petroleum Refiners' Association. The sessions will be held in the Muehlebach Hotel, March 3. The date was announced last month and the members given opportunity to select a meeting place, Chicago, Tulsa and Kansas City being put up for the vote.

The convention this year will be a departure in that it will be for one day only and the program will consider matters of interest to refinery executives only. Technical subjects and those pertaining to traffic and similar questions are being cared for through group meetings, which will be held frequently over the Mid-Continent area.

The program for the one day has not been completed. The present plan is to open the meeting in the morning, serve lunch in the meeting room and then continue into the afternoon, thus completing the meeting at one session.

* * * *

Gasoline Men At Tulsa—

Tulsa.—One day of the next annual convention of the Association of Natural Gasoline Manufacturers will be devoted to problems of plant operators. The decision to revive this part of the annual program came at a meeting of the Executive Committee here January 20, when May 24, 25 and 26 were fixed as dates for the annual convention.

All sessions will be held in the Mayo Hotel here. This is the latest convention date ever set for the association. The selection was determined in order to allow a report on almost a whole year of the first educational effort made by the association. The year on this effort will close June 30. E. L. Peck, president of the association, will name a convention committee within a few days. This committee will work out the whole program. One day will be devoted to a consideration of motor fuels, especially the part natural gaso-motor fuels. Refiners of crude oil will have a part in the program. If possible the motor the association used at the last meeting of the Natural Petroleum Association in Atlantic City will be installed in Tulsa for testing of various fuels.

George Granger Brown of the University of Michigan, who has had charge of the scientific work of the association's educational campaign will have a leading part in the motor fuels section of the program.

In returning to the plan of devoting a day of the program to the problems of plant operation, the association is picking up something it instituted at its second convention. Recently this has been left out, since plant operators' meetings have been held in various gasoline manufacturing centers several times each year.

The Executive Committee also voted to begin its meetings of plant operators in March of this year, with a series in Texas. These will begin in March. One will be held at Ranger, another at Wichita Falls and possibly one at Amarillo.

IF THEY ASK YOU?

Suppose your own company is considering the installation of gas engine driven compressors and you are asked for your recommendation on the equipment to install.

It will be to your interests if you can make a recommendation for which you need never have to apologize. The man is fortunate who can always feel sure of his choice when such an opportunity comes.

Men in positions to make such recommendations more frequently recommend Cooper equipment. Either their own experience or the experience of men they know has demonstrated Cooper compressors and Cooper service to be so thoroughly dependable.

THE C. & G. COOPER COMPANY, MT. VERNON, OHIO

1605 Kirby Bldg., Dallas **504 Kennedy Bldg., Tulsa**

649 South Olive St., Los Angeles

COOPER

Mention Where You Saw the Advertisement

Trend of California Absorption Practice

Efficiency of plant equipment is increased through willingness of operators to experiment and exchange ideas

By PAUL BARTON

HAVING discussed the general aspects of the trend of the California Natural Gasoline Industry, we shall now analyze briefly the absorption plant itself and try to see what effect the development is having upon the individual parts and operations. Naturally, the development of the plant as a whole, although coming first, has had a marked influence upon the design of the various plant members.

THIS is the second of a series of twelve articles which will compose a record of the natural gasoline industry on the Pacific Coast. Each will cover a distant phase of general development.

The third article will appear in March number of The REFINER AND NATURAL GASOLINE MANUFACTURER.

The Absorber

The absorber has received by far the greatest amount of study. The old idea that an absorber had to be tall to be efficient has almost disappeared. The plants with batteries of 50, 60 and even 90-foot towers are giving place to compact units with but one or two absorbers less than 30 feet high, and these latter handling large volumes of gas with a greater efficiency. As is usual when a departure is made from established methods, the pendulum swing is a wide one. Once convinced that the new type (bubble towers) were superior to the old type (surface contact), engineers stopped all consideration of the older type.

The fallacy in this tendency to make radical changes in plant equipment lies in the assumption that one type is superior to the other, rather than that it is the design of the representative piece of equipment of a certain type which is more up-to-date and of greater merit. In fact, each of the two general types of absorbers have inherent advantages over the other.

However, it is not the purpose of this paper to discuss the merits (or otherwise) of the various absorbers in use in California. The situation at present seems to be that, although admitting that wonderful strides have been made in absorber development, natural gasoline engineers are convinced that considerable improvement is to be expected. The outstanding idea as to the nature of this future development of absorbers may be best illustrated by comparison with the testing of gas for gasoline content. It is a matter of common knowledge that the efficiency of a charcoal test (or any of the other empirical methods) varies widely with the chemical constitution of the gas being tested. This condition is equally true of an absorber of fixed design, its extraction efficiency is certainly not identical in the various fields. It is a frequently heard expression that a certain gas is "easy to treat" or "hard to treat" as compared with gas from some other source being handled similarly.

As stated in a preceding article, the advancement of the natural gasoline industry has closely paralleled the development of testing practice. This has been particularly noticeable in absorber design. However, it must not be overlooked that testing practice is still on an empirical basis, and even though a certain absorber installation may be performing 100 per cent as measured by test results, the test itself may not reflect the true condition. Apparently, the California industry has carried the development of the absorber to near its maximum efficiency as judged from present testing methods, and further advancement must be expected from strict scientific considerations, designing for particular conditions rather than general.

The Still

Several factors have been at work in the progress of absorption plant still design. Well established principles were available from refinery practice, and while there has been a great variety of forms used, correct principles were usually present and short-comings were traceable to limited capacity or lack of flexibility. The study of still performance has been considerably handicapped by the absence of a definite and dependable testing procedure, the present development coming mainly from correlative observation in the study of absorbers. Recently, the tendency in still design has been along the lines of absorber design, becoming both simpler and more flexible. It is now almost universal practice to do the entire heating of the oil outside of the still, using tubular preheaters with live steam at about 125 pounds pressure. A comparatively small quantity of oil is carried in the still at ony one time, the operation being very similar to that of the absorber.

The practice of maintaining the distillation system under a positive pressure is quite common. This pressure is usually at least 10 pounds, and in some instances high enough to permit the vent gases to be put into the absorption system. The use of exhaust steam for agitation has been found to be advantageous as it minimizes the cooling effect incidental to the expansion of high-pressure live steam. The average steam consumption of stills of the type mentioned is from one-quarter to one-half pound of steam per pound of gasoline, increasing materially of course with the operating pressure of the still.

Dephlegmator or Fractionator

The original so-called "dephlegmators" of early absorption plants were nothing more or less than primary condensers. The purpose for which they were used, the control of the final boiling point (or end point) of the gasoline, did not impose a very severe condition as there is a lee-way of approximately 100 degrees F. between the end point of an oil-free natural gasoline and that of ordinary absorption gasoline. However, the principles of fractionation have gradually entered the design of absorption plant control dephlegmators, the effect of which is readily apparent when the nature of the dephlegmator "bottoms" is observed. In fact, the nature of this product has changed from that of a usable motor fuel to that of nearly pure absorption oil (frequently showing an initial boiling point nearly as high as the original oil).

Observation of this trend led the writer to predict a future development in absorption plant dephlegmation in which true rectification would be used. This prediction has been borne out by the recent appearance of the Funk Fractionating Evaporator. One of the great advantages which this type of equipment possesses is that there is practically no loss of absorption medium from the distillation system. In other words, the characteristics of the absorption oil (particularly as regards

(Continued on page 102)

California Absorption Plant Takes Small Ground Space

Richfield Oil Company's new installation at Huntington Beach embodies late extraction equipment on small site

By GEORGE REID
Staff Representative

EMBODIED in the construction, design, and operation of the Richfield Oil Company's recently completed absorption gasoline plant at Huntington Beach, California, are several features of interest. Among these features, probably the more important embraces the design and lay out of the entire 20,000 gallons gasoline extraction apparatus on a very small plant site, and the installation and operation of the newly developed devices for the collection, separation, and return to the system of the condensed water and heavier reflux material which has as its source the so-called dephlegmator, or partial condenser. These items of equipment and operation will be described later in this writing.

The accompanying sketch illustrating the manner in which the company's gas department engineers laid-out the new plants is of interest. In Figure 1 is shown the location of the gasoline plant equipment, the compression plant, the various items of absorption plant equipment, cooling towers, boilers, tankage, office and other buildings, all of which are fitted neatly and compactly onto a site the dimensions of which are only 200 feet by 113½ feet. The installation is surrounded by Cyclone fencing with all of the required equipment for gasoline manufacture compactly arranged within the small area mentioned. This diagram may also serve as a flow chart for the plant.

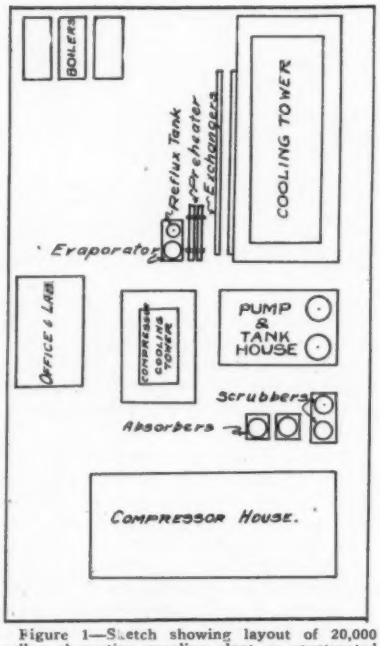


Figure 1—Sketch showing layout of 20,000 gallon absorption gasoline plant as constructed on a site 200 by 113½ feet. Richfield Oil Company's Huntington Beach plant.

Construction

The buildings housing certain items of equipment are constructed of corrugated sheet metal, well lighted and ventilated. This is especially true of the compressor plant. Natural gas from the field enters the compressor, or booster plant, under pressure of about five pounds. Here it is boosted to 35 pounds, the operating pressure of the absorption gasoline plant. Three C. & G. Cooper gas engine compressor units are employed in compressing the natural gas. These units are size, 18 inches by 20 inches at the engine end and 17 by 20 inches on the compressor end.

It is readily seen that these three units handling practically five and one-half million cubic feet of natural gas daily are carrying on under more than peak load conditions. The company contemplates the early installation of an additional compressor unit, for field conditions definitely point to further increase of gas production. The Cooper compressor units are cooled by water which is circulated over the machines and through the cooling tower by Fairbanks-Morse five horsepower induction motor driven three-inch centrifugal pumps, one on duty and one auxiliary, which handle the water at about 20 pounds operating pressure.

The gas entering the compressor station is first scrubbed in the usual manner, and after being cooled in the cooling tower, it is again scrubbed before it enters the absorbers. A final scrubbing is given the dry gas leaving the absorption equipment.

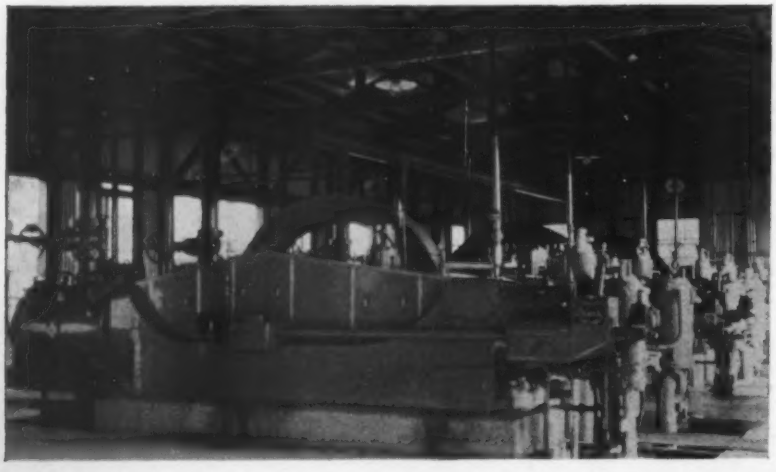


Figure 2—Showing interior of compressor plant at Richfield Oil Company's Huntington Beach plant.

Absorption Equipment

Campbell Oil Froth absorbers are used or perhaps it would be better to state that the entire absorption plant is standard Campbell equipment. This type of absorption plant has previously been discussed at some length in *The* REFINER AND NATURAL GASOLINE MANUFACTURER (May, 1926), and at this writing only a brief description of the familiar equipment is necessary.

The absorbers, which are of standard size, six by 24 feet, and of which there are only two, are handling the entire throughput of natural gas, the absorbing procedure yielding at present a daily average of some 17,000 gallons of natural gasoline. Huntington Beach gas is usually designated as three-gallon gas by gasoline plant operators, and the production at this plant is not at all out of line. The two absorbers as installed are capable of producing 20,000 gallons of gasoline daily with the same satisfactory efficiency as obtained at present. The absorber installation is shown in Figure 2.

The absorption oil is circulated by Worthington pumps, size 10 by 7 by 10 inches. The pump handling the rich oil from the absorber and discharging it through the preheaters to the stripper is controlled automatically by Fisher Oil level controllers at the absorbers which are connected by small cables strung to a Mason steam regulator on the steam line leading to the oil pump. The regulator devices control the steam to the pump and hence the flow of oil from absorbers to still, or stripper. Water circulating pumps

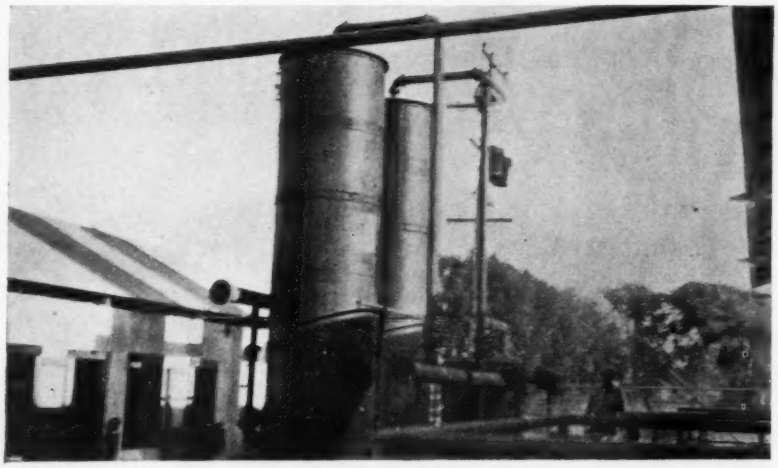


Figure 3—View of two absorbers in which 17,000 gallons of gasoline is at present absorbed. Rated capacity is 20,000 gallons. Richfield Oil Company's Huntington Beach plant.

are also Worthington 9½ by 8½ by 10 inches in size.

Heat Interchanger

Rich oil leaving the absorbers passes counter current to hot lean oil leaving the stripper in the standard Campbell heat interchanger. Leaving the intechanger the warm enriched or fat oil passes next through the steam preheaters and then into the stripper. The lean oil from the stripper after flowing through the interchanger where it imparts some of its heat to the rich oil, is conducted to the cooling tower, cooled, and returned to the absorbers.

Figure 4 shows the details of the heat-interchanger, preheater and stripper installation, snugly fitted and arranged just back of the pump house and adjacent to the two cooling towers. The stripper is also standard size, five feet by about 19 feet.

The preceding paragraphs briefly describe the method of operation and the equipment employed up to and including the distillation units. It may be well to insert here that wherever necessary or desirable, meters are installed for measuring both rich and dry gas and absorption oil.

When the absorbed gasoline is distilled from the absorption oil in the stripper, the vapors released are dephlegmated or fractionated in the upper three plates or sections of the stripper to some extent, and then conducted through the vapor line to the top of the cooling tower. At this point is installed the Campbell type partial condenser, which has been erroneously termed a dephlegmator. The equipment as installed at this plant is a departure from the former installations by the same engineering company.

The partial condenser consists of a continuous coil partially submerged in water in a flat open box at the top of the cooling tower. The vapors entering the device are conducted through these coils where the temperature is reduced sufficiently to cause the condensation of the steam or water vapor present in the gasoline gases driven from the absorption oil in the stripper. The steam employed in agitation in the stripper is, naturally, the source of this water. In addition, the temperature maintained is such that all of the heavy particles of the gasoline vapors are also condensed. This temperature is maintained by a small stream of cool water entering the box, the volume of which is controlled by a Foxboro automatic recorder controller.

After the partial condensation in the coils the mixture of heavy ends, water, and gasoline vapors pass through a small mist extractor where all of the condensed portion of the mixture is removed and the gasoline vapors conducted into the final condenser coils, condensed and collected in steel storage as finished product. Taking advantage of the static head provided by the height of the mist extractor, 36 feet above ground, all of the water and heavy gasoline, or reflux, is removed to ground level to a small tank which is termed the de-watering tank. In this tank the rflux material and water separates and the level of the water is controlled by a large float control device. This float con-

(Continued on page 102)

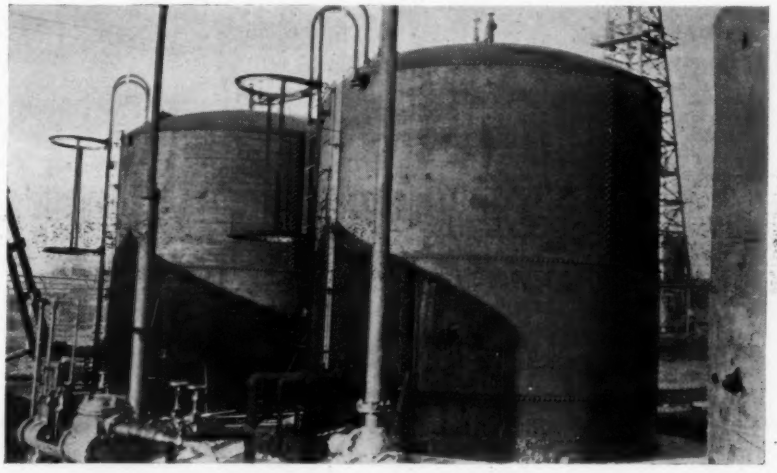


Figure 5—Gasoline storage tanks before installation, showing safety guards attached to prevent accident to guagers. Richfield Oil Company's Huntington Beach plant.

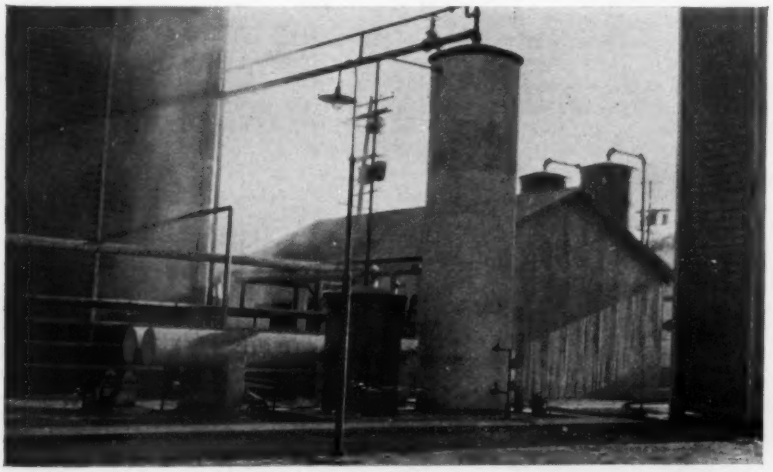


Figure 4—View of heat interchangers, pre-heaters, stripper (still) and de-watering tank. Richfield Oil Company's Huntington Beach plant.

Engineers Meeting Promises Much Technical Progress

Many prominent engineers, chemists and economists scheduled to speak before A. I. M. E. at New York

New York.—Advances made in refining technology during 1926 will be thoroughly discussed by refining experts at the coming meeting of the American Institute of Mining and Metallurgical Engineers, to be held February 14-17, inclusive.

The program of the refining section carries the names of practically all outstanding authorities in the American refining industry and promises much interesting and valuable information.

The program as recently announced is given below:

(1) REVIEWS FOR 1926

Thursday, February 17th—8:00 p. m.

1. Production and Development in 1926—James H. Gardner, president Gardner Petroleum Company, Tulsa, and vice-chairman Production, Petroleum Division A. I. M. E.

2. Advances in Refining Technology—Charles H. Osmond, Crandall & Osmond, New York City.

3. Advances in Production Engineering—T. E. Swigert, Production Engineer Shell Company of California, Los Angeles.

4. The Trend of the Petroleum Situation—Joseph E. Pogue, Consulting Engineer, New York City.

(2) REFINING SYMPOSIUM

Two Sessions

Wednseday, Feb. 16—9:30 a. m.—2:00 p. m.

Charles H. Osmond, Vice-chairman, Presiding

1. Advances i n Cracking—A free discussion not to be published.

2. High Cracked Gasolines: (a) Chemistry—Dr. Benjamin T. Brooks, Consulting Chemist, New York. (b) High Cracked Gasolines and High Sulphur Content—Jacques Morrell, Gustav Egloff, Universal Oil Products Company, Chicago. Discussion: I. K. Giles, Warner-Quinlan Company, Warners, N. J. H. R. Gunlac, Inter-Ocean Refining Company, Baltimore, Md.

3. Recent Developments in Fractionation as Applied to Tube Still Distillation—C. L. Smith, Pure Oil Company, Chicago. Discussion: Herschel Smith, Gulf Refining Company Houston; H. E. Widdell, Arthur G. McKee & Company, Cleveland; W. A. Peters, E. B. Badger & Sons, Boston; Walter E. Lummus, president Walter E. Lummus Company, Boston; George A. Burrell, Pittsburgh; H. O. Swanson, Power Specialty Company, New York.

4. New Methods of Refining Lubricating Oils—E. R. Lederer, Texas Pacific Coal & Oil Company, Fort Worth. Discussion: Walter Miller, vice-president Marland Refining Company, Ponca City, Oklahoma.

5. Low Vacuum Process in Refining Asphaltic Base Oils—John Schulze, Red River Refining Company, Burnham, Ill. Discussion: J. A. Kramer, Shell Company of California, Los Angeles

6. Refining Light Mexican Crudes—John Poole, Mexican Eagle Company, Tampico, Mexico.

(4) CORROSION SYMPOSIUM

Two Sessions

Thursday, Feb. 17th—9:30 a. m.—2:00 p. m.

Frank N. Speller, Presiding

1. Introductory Remarks: Cooperative Research and the Corrosion Problem—F. N. Speller, Pittsburgh.

2. Corrosion Research—Udlick R. Evans, King's College, Cambridge, England.

3. Sulphur in Petroleum—A. E. Wood, Mississippi College, Clinton.

4. Use of Ferrous Alloys as a Preventive of Corrosion—John A. Mathews, vice-president Crucible Steel Company of America, New York.

5. Use of Alloys as a Corrosion Preventive in Europe—William Minot Cuertler, Berlin, Germany.

6. Corrosion of Pumping Equipment—Discussion led by Hamilton Garnsey, Jr., Goulds Pumps, Inc., Seneca Falls, N. Y.

7. Pipe Line Corrosion-Suggested Research Activies—E. P. Bly, Standard Oil Company of California, San Francisco.

8. Corrosive Effect of Soils on Pipe Lines—Kirk H. Logen, U. S. Bureau of Standards, Washington. (This paper was prepared for this Petroleum Division, A. I. M. E. Corrosion Symposium, but was presented, in slightly altered form, at the Corrosion conference of the A. P. I. meeting at Tulsa. It will be open for discussion at this meeting. Mr. Logan will present the final results of the fourth year period of the Bureau's Soil Corrosion tests at this session.)

9. Corrosion as Affecting Gasoline Plants—R. W. Finney and H. W. Young, Midwest Refining Company, Casper, Wyoming. Discussion: George A. Burrell, Consulting Engineer, Pittsburgh.

10. Refinery Corrosion Problems—Walter Samans, Chief Engineer, Atlantic Refining Company, Philadelphia. Corrosion of Pressure Stills: Gustav Egloff, Universal Oil Products Company, Chicago, Ill.

11. Refinery Corrosion Problems—H. F. Perkins, Gulf Refining Company, Port Arthur, Texas. (This paper was prepared for this Petroleum Division, A. I. M. E. Corrosion Symposium, but was presented, in slightly altered form, at the Corrosion Conference of the A. P. I. meeting at Tulsa. It will be open for discussion at this meeting.)

12. Oil Well Corrosion—Its Causes and Prevention—R. Van A. Mills, Petroleum Engineer U. S. Bureau of Mines, Bartlesville, Okla.

Botfield Refractories New Distributors

The Botfield Refractories Company of Philadelphia, Pa., has recently appointed the following concerns as distributors of Adamant Fire Brick Cement:

Southern Steel & Cement Co., Asheville, N. C.

Henry A. Petter Supply Company, Paducah, Ky.

Columbia Supply Co., 823 West Gervais St., Columbia, S. C.

Spartanburg Mill & Supply Co., 218 Ezell St., Spartansburg, S. C.

Amarillo, Texas. — The Columbian Gasoline Corporation, a subsidiary of the Columbian Carbon Company of Monroe, Louisiana, has contracted for the natural gasoline rights on the gas handled by the Northern Texas Utilities Company in delivering industrial and domestic fuel to consumers at Wichita Falls and intermediate points from Wheeler County section of the Texas Panhandle. The Columbian Carbon Company is building a high pressure absorption plant on the above gas line near Shamrock, Texas, to handle about 40,000,000 cubic feet of gas daily, with a gasoline yield of about one-fourth of a gallon per 1000 cubic feet. W. E. Reardon is in charge of the construction work on this new plant, with headquarters at Monroe, La.

Isometric Maps Make a Picture Of Refinery Piping

Pipe line buried underground with no record kept of location and purpose, may lead to expensive complications

By H. H. KELLY,
Engineer

AS a rule, when a group of men decide to build a small refinery the work is done by an outside contractor, and except for the general location of buildings and major units, the owners rarely see the detail plans by which the refinery is to be run. The result is that a great deal of the piping work is planned in the field and no record is ever kept.

The superintendent usually has been chosen before the work is started and he and the contractor agree upon the lay-out, very often in a verbal manner only. This is in order as far as piping is concerned that is above ground, but when pipe lines are buried and no drawing is made showing their location it is a positive crime that cannot be too severely censured. Of course the usual excuse it that the superintendent knows every inch of the ground and what is under it. That is all very well but no superintendent lasts forever and the man who succeeds him certainly has a tough porposition in memorizing the various leads of piping. For the underground lay-out he has to take the word of some subordinate who may or may not have the right information.

Changes in the working staff usually follow in the appointment of a new executive and this opens up an easy field for a disgruntled man under discharge orders to pass on wrong information to his successor. Cases have been known where through such wrong information being given regarding pump manifolds, crude oil has been pumped into finished gasoline tanks. All chances of this sort of an occurrence can be avoided by making a plan showing exactly where each line is located and its duties.

Material Saving

In a refinery already in use the preparation of such a plan probably will be looked upon as an unwarranted expense because of the labor involved in digging over the plant, but this would soon be balanced by the detailed knowledge gained of the piping and the future possibilities that may be held in the flexibility of moving commodities from one location to the other. Another positive fact is that enough material will be found hidden in the ground in refineries after having been built three or more years to pay for the work being done.

Every one knows that when changes are made in the piping of a refinery it is always rush work, and connections are made from one line to another with the minimum amount of fittings and piping and very little thought to the added work required of the particular pump in question through friction loss. With the aid of the map it can be readily seen what an incredible amount of twists and bends any lead of pipe in the field has taken from its original course from tank to pump. This additional friction loss means added power consumption and increased operating costs.

The most economical way to make the drawing under discussion is to have a plan view of the area in question, then isometric views to a larger scale showing in detail pump and tank manifolds or any particular part that is crowded with valves, cocks, etc.

Figure 1 shows a small section of the plan view of a refinery piping arrangement covering the run down tank block. These tanks are 30 feet in diameter and 10 feet in height, with a capacity of 1250 barrels.

As will be seen, no detail information coving type of valves or the run of tees, etc., can be had from this plan view, but when taken in conjunction with Figure 2, it is a very different matter.

Here is seen at a glance, just how the piping is manifolded, where valve, tee or ell is placed, the length of piping that is above ground in this locality and what is underground work.

All sizes of piping, valves, etc., are clearly shown, and the leads of each commodity can be followed through from tail house to any individual tank.

Maps Constant Reference

When a commodity of a tank is to be changed, say from 902 to 904, the engineer can follow out the particular pipe line on the map, and locate what valves have to be opened, and which valves closed, before he ever starts the operation, leaving nothing to chance. If he finds that it cannot be done with the line at his disposal, he can estimate exactly what fit-

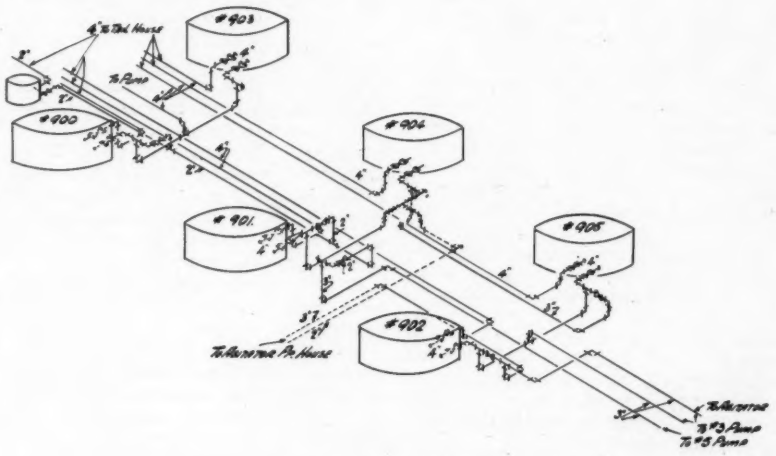


Figure 2—Isometric of rundown tank connections.

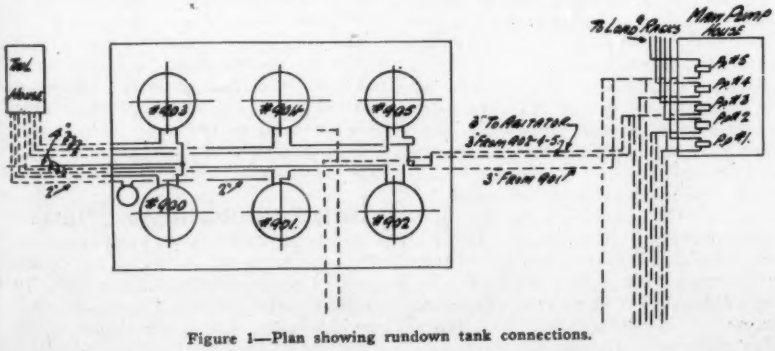


Figure 1—Plan showing rundown tank connections.

tings and pipe he will require, and just how much labor he will have to have and the time required to make the alteration.

On the whole map of this refinery an isometric view is shown, giving the details of the main pump house manifold, and the tail house piping. The main pump house manifold isometric shows all suction and discharge connections from the field storage, run down tanks and loading racks. It is very complete, and of great assistance to the pump house and loading rack men.

A copy of the map is also hung in the tail house, so that the stillman can make no mistake as to which tank they are running into from the look boxes.

Thus any mechanic, after a little study of the map, can operate all manifolds and make any transfer that is practical with the equipment he has at his disposal, with the certainty that he is right and that he is not opening or shutting a valve because some "Tom, Dick or Harry" has informed him that was what had been done before.

The isometrics can be more easily understood by the ordinary mechanic than the orthodox drawing showing plan, elevation and section. It is more like a photograph, as all three views are combined in one. Isometric projection is rectangular projection on a plane equally inclined to three principal axes of an object, so that lengths parallel to these are represented proportionally.

The principle can be very easily followed out by placing any rectangular object on one side and drawing it as you see it, making all angles from the horizontal 30 degrees.

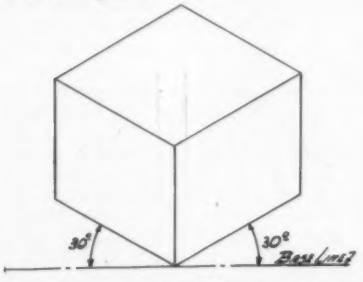


Figure 3—Box method of illustrating isometric projection.

Small photostat copies can be made up into book form and these can be placed in the offices of the executives for ready reference regarding future expansion.

Of course, refinery piping is never the same from one month to another, since experiments are always being made, and the most essential part of the map-making work is to keep it up to date. As each change is made, the engineer in charge should embody it on his maps immediately, so that he can explain in graphic form (if the experiment was or was not a success) just why he made the expenditure in the plant.

It is also of great help in estimating new work, or the amount of material that can be salvaged. It will save innumerable trips by draftsmen to the refinery from the main office, as all information is right there and can be had at any time. Also as a record for inventory of permanent equipment, it cannot be beaten.

Effects of Corona Discharge on Petroleum Studied By Bureau of Mines

MUCH interest has been manifested during recent years in the use of the cornoa discharge during the cracking of petroleum to increase the production of gasoline, states the Bureau of Mines, Department of Commerce, in a recently issued report. It is known that ionization may be caused by high voltages as well as by purely thermal means and that apparently some relationship exists between electrical and thermal activation. By means of electrical activation some chemical reactions may be made to proceed at tempreatures lower than when thermal activation alone is employed. The chemical effects, however, even when a very high-voltage corona is used, are of small magnitude and in keeping with the comparatively small amount of energy which may be applied by using the corona.

In the polymerization of benzene, however, the corona effect is of major importance. Although it is theoretically possible that benzene may be polymerized by high temperatures, the product formed would probably be unstable at such temperatures and would decompose.

Claims have been made that the use of a high-frequency discharge would by its high frequency, cause some molecular rearrangement and vibrations of the molecules and electrons that would bring about chemical changes. When it is considered, however, that the frequency of vibrations of the electrons and atoms composing a molecule is many thousands of times greater than that of the high-frequency current, chemical changes from the effects of any high-frequency current seem improbable.

The corona discharge probably has two effects when used during the cracking of oils—a chemical action and a mechanical or precipitating action. There is, undoubtedly, some direct chemical effect due to the use of the corona. Many investigators have studied both low and high frequency discharges on different gases and vapors, and in virtually every case the investigators have reported some effects. The effect is, however, comparatively slight and in keeping with the relatively small amount of energy of the corona. The mechanical or precipitating effect may be important.

Experiments made by Bureau of Mines chemists indicate that the decomposition of natural gas by the electric arc is not purely a thermal effect or heat reaction.

The increased cracking obtained by the use of the corona during the thermal cracking of oil appears to be due: To precipitation of the hot oil vapors or mist particles against the walls of the cracking tube; and to the decreased amount of channeling by the "electric wind" set up by the corona discharge. The effects are due largely to a purely mechanical or "precipitation" effect of the corona discharge on the droplets and particles in the field between the corona discharge wire and the walls of the tube.

In cracking petroleum, compounds of many different molecular weights and boiling points are present in the cracking tube. The lighter, more volatile constituents exist as grease at the cracking-tube temperature. The heavier hydrocarbons, however, exist as vapor or mist. The gases are unaffected by the corona, whereas the vapor or mist particles are precipitated against the hot walls of the cracking tube by the corona discharge, and increased cracking results. Although the increased cracking obtained when the corona was used in experiments made by the Bureau of Mines was only five to eight per cent, it is possible that a higher percentage would be obtained in larger cracking tubes. The data indicate that the greater the tendency of the gas to "channel" the greater should be the effect of the corona.

Because the physical properties of compounds in the form of gases or mists differ, the effect of the corona is selective. This action suggests its use in the exit line of a cracking still to prevent the heavier fractions from being carried along by the cracked gasoline (existing as a gas at the cracking-tube temperature) into the dephlegmators and condensers. In this way the corona would serve three useful functions: Reduce the load of the condensing system; increase the over-all thermal efficiency of the plant by preventing the loss of the heat of the condensation and re-evaporation of heavy hydrocarbons; and increase the thermal efficiency of the still by keeping the heavy hydrocarbons continually in it.

The corona precipitator may also be used in special knockdwon boxes or tubes and fractional condensers; also in increasing the efficiency of condensers by preventing or minimizing channeling of the through-going vapors. Such applications would be similar to present uses of the electrostatic precipitator in many industries, especially acid-mist precipitation in sulphuric acid and similar plants.

The results of studies of the effects of the corona discharge on petroleum are given in Bureau of Mines Technical Paper 375, by J. J. Jakosky, which may be obtained from the Superintendent of Documents, Washington, D. C., at a price of 10 cents.

Improve Kansas Plant

Neodesha, Kansas. — Improvements at the plant of the Standard Oil Company of Kansas will increase capacity by 4000 barrels daily. Holmes-Manley pressure stills are being installed. A tar distillation unit is also to be added.

Corrosion in Natural Gasoline Manufacture

By R. W. FINNEY and H. W. YOUNG

FORMATION of scale in boilers and other industrial equipment, and the corrosion of such equipment, are closely related problems. Since in the petroleum industry these problems cover a very broad field, this paper has been confined to the effects of scale and corrosion on gas engines, compressors, pipes and fittings, used in plants extracting gasoline from natural gas, and the steps taken in arriving at a workable plan for combating these evils at the Midwest Refining Company's plants in the Salt Creek Field, Wyoming.

Eliminating, or at least minimizing, the many deleterious effects occasioned by the use of bad water in jackets and cooling systems of gas engines and compressors has been the subject of much study for many years but no generally accepted plan has been evolved. The problem was unusually difficult at Salt Creek, as the severe winters of Wyoming bring operating conditions quite different from those encountered in warmer states, and the water available was especially bad.

While the conditioning of water to prevent scale and to lessen corrosion may not be a particularly difficult problem in plants in large industrial centers, it becomes much more difficult when attempted at plants remote from railroads and by men without previous experience to guide them. In fact this difficulty has been so great in the Wyoming oil fields that until comparatively recently it has been the practice to allow much equipment to be ruined rather than to attempt corrective measures.

At the Midwest plants this problem was given attention first by the plant men and later by both plant men and laboratory staff. To the latter it was simply one of many problems which arise in connection with field and plant operations, which must be studied and, if possible, solved. Many mistakes were made during the course of this investigation, but since mistakes, properly interpreted, are of value in guiding one's steps aright, it is believed that a review of the different stages of development which have led up to the present method of handling this problem will prove of interest to the industry.

The first gasoline plant in the Salt Creek field was built by the Midwest Refining Company in the fall of 1917. The plant has been enlarged from time to time since then, and 20 booster stations have been installed for collecting gas throughout the field. At present there is in operation in the main extraction plants the following equipment.

Plant Equipment

Eighteen 160-horsepower twin two-cycle Bessemer gas engines belted to nine two-stage 16 by 8 by 16 Ingersoll-Rand compressors and nine two-stage 16 by 8 by 16 Laidlaw compressors, operating at 0-pound intake and 250-pound discharge, pressure.

Seven 970-horsepower twin four-cycle tandem double-acting Cooper gas engines direct-connected to two-stage 32 by 15 by 36 Cooper compressors, operating at 0-pound intake and 250-pound discharge, pressure.

Six 165-horsepower twin four-cycle single-acting Cooper gas engines direct-connected to 5 by 20 Cooper compressors, operating at 200-pound intake and 400-pound discharge, pressure.

Seven 165-horsepower twin four-cycle single-acting Cooper gas engines direct-connected to 17 by 20 Cooper compressors, operating at 0-pound intake and 35-pound discharge, pressure.

In the 20 booster stations there are 57 Bessemer 80-horse power two-cycle direct-connected gas engine-driven compressors and 16 Clark 80-horse power two-cycle direct-connected gas engine-driven compressors. The compressors are Bessemer, Clark and Laidlaw in sizes 14 by 20, 16 by 20, 18 by 20, 20 by 20, and 23 by 20, with intake pressures ranging from 12-inch of mercury vacuum to 0-pound and discharge pressures ranging from 3 to 25 pounds.

In addition to the water jackets on all gas engine and compressor cylinders, the steel piston rods on the 970-horse power Coopers are water-cooled.

Trouble With Raw Water

The gas engines and compressors in the plant first placed in operation were cooled by pumping raw water through the jackets, the water being cooled in an ordinary cooling tower where it was sprayed through nozzles. This method was very effective in cooling the water, but the windage loss was high and the concentration of salts in solution by evaporation led to serious complications. Such concentration caused a rapid deposition of scale inside the jackets and in the pipes carrying the water from the jackets to the towers. The heavy scale inside the jackets reduced the heat transfer, which in turn decreased the power developed and caused damage to the engines due to excessive heating of the cylinders. The net effect was a lowering of plant capacity and general efficiency.

Several attempts were made to remove the scale with dilute hyrochloric acid but it could not be satisfactorily removed in this way. Failure was probably due in part to the presence of a high proportion of calcium sulfate in the scale, which greatly retarded solution by the acid, and in part to timidity on the part of those in charge of the work. But even had the removal of scale with acid been complete the time lost to the units in applying the treatment would have been sufficient to condemn the process.

To give a better idea of the difficulties involved, the analysis of several waters which were available at that time are given. Since the seasonal variations in these waters are often quite large, two analyses are given, representing roughly the two extremes. The proportions are in parts per million, which in the headings is abbreviated to "P. P. M."

No analyses of the concentrated waters of that period are available but several were made later on waters which should have been practically identical with the

THIS paper was prepared for presentation before the meeting of the American Institute of Mining and Metallurgical Engineers in New York, February 14 to 17. It is being published in advance in order to allow study, so it can be discussed at the New York meeting.

Discussion at the meeting is preferable. Discussion in writing may be sent to the Institute, 29 West Thirty-ninth Street, New York.

Mr. Finney is superintendent of the gas and electric departments of the Midwest Refining Company at Casper, and Mr. Young is research engineer of the field department of the same company. *The article is copyrighted by the American Institute of Mining and Metallurgical Engineers.*

Analyses of Waters Showing Range of Saline Content

	Salt Creek P. P. M.		Castle Creek P. P. M.		Pond P. P. M.	
Calcium sulfate	1,060	333	1,210	1,251	762	858
Magnesium sulfate	1,105	138	1,050	1,140	714	655
Sodium sulfate	2,010	88	8,315	3,540	2,310	2,320
Sodium chloride	39	20	133	225	690	389
Sodium bicarbonate	465	135	680	737	380	513
Sodium carbonate	0	0	44	0	0	0
Total solids	4,679	714	11,432	6,893	4,865	4,735

earlier waters. The following is representative:

Representative Aanalysis of Concentrated Waters

	Concentrated Water P. P. M.
Calcium sulfate	1,292
Magnesium sulfate	4,250
Sodium sulfate	25,800
Sodium chloride	1,145
Sodium bicarbonate	622
Sodium corbonate	33
Total solids	33,142

Condensed Water

The second step differed from the first in only one particular, condensed water was substituted for hard water. The high altitude, low humidity, and the prevalence of high winds, combined to make evaporation and windage losses so high that on the score of expense alone this system could not be considered. In addition, the condensed water proved so corrosive that failure of piping and Cooper pistons necessitated frequent shutdowns and costly replacements. But neither at this time nor later, was there any trouble experienced with corrosion inside the cast-iron jackets of any of the units.

Since it was impossible to conserve water in the open sprays, and the oxygen absorbed in those sprays was proving so destructive, it was thought that the loss of circulating water would be greatly lessened and greater opportunity given for combatting corrosion, by the use of the closed system, which consists of circulating the cooling water through banks of coils which were cooled by spraying water over them. The results justified the first hope, but the second was not realized, although several corrective measures were applied.

To exclude air as far as possible from contact with the circulating water, the pipes leading from the Cooper jackets, which normally spill the water into bowls, from whence it gravitates to the pumps, were connected directly to the pipes leading to the pumps, and several unsuccessful attempts were made to connect the lines from the water-cooled piston rods directly to the lines leading to the pumps. Corrosion and pitting continued, regardless of all these precautions.

A large metal box filled with steel shavings was then placed in the system to remove the oxygen. The volume of rust formed was sufficient in a short time to greatly impede the flow of water through the box, also a considerable amount of iron passed into solution and was deposited in other parts of the system. Such experiments were also made with oxygen removal by passing the water through a large pipe packed with zinc shavings sprinkled with copper sulphate solution. Some very encouraging results were obtained with this method but the performance was very erratic. Any oil or rust in the water coated the zinc and rendered it inert, while exposing the wet zinc to the atmosphere for only a few minutes resulted in rapid oxidation and total loss of activity.

Oil Circulated

For a short period at one of the plants lubricating oil was circulated instead of water. This naturally solved the corrosion problem, but, due to the low specific heat of the oil, the heat transfer was very poor and the units ran too hot to operate efficiently. Some consideration was also given to the possibility of obtaining piston rods and piping made of alloy steels known to possess special corrosion-resisting properties. This was abandoned, however, on account of the cost.

Since none of these expedients promised relief from corrosion, a fourth was tried. Raw water containing scale-forming solids was mixed with the condensed water, in the hope that a light scale would form which would not seriously interfere with the heat transfer but would protect the metallic parts of the system from corrosion, particularly those which were exposed to considerable heat, as the Cooper piston rods. Experience proved that the scale formed was not uniform, some parts being covered with a scale so thick that it interfered with the heat transfer while nearby the metal was quite unprotected. The exposed parts corroded very rapidly. It seemed quite impossible to regulate the volume of raw water to give efficient protection from this intense localized corrosion.

Since it is generally recognized that as a rule slightly alkaline waters are less corrosive than neutral waters, it was thought that by using water treated by the lime-soda ash method the formation of scale could be prevented and at the same time corrosion minimized. The lime-soda ash treatment was carried out in 100-barrel tanks by the intermittent system, the water being heated to at least 80 degrees Fahrenheit, by injecting steam, and stirred with compressed air after the addition of the chemicals. As a rule the hydroxide and carbonate alkalinites were about 40 to 60 parts per million respectively.

Chemical Treatment Objectionable

After some experience with this water it was found that corrosion was as bad, if not worse, than with condensed water. Also there was considerable deposition of sludge in the jackets, which caused damage and necessitated shutdowns for cleaning. The presence of the sludge was probably due in part to the water being pumped from the treating tanks before settling was complete, and in part to the precipitation of residual calcium and magnesium compounds in the cylinders, where high temperatures obtained. The fact that air was used in mixing the water during the addition of the chemicals may have caused corrosion to be more severe than it would otherwise have been. However, had even an inert gas been used for stirring, it is hardly probable that the results would have been very materially different.

The experience gained over a period of several years, as covered by the methods and schemes described above, led to renewed efforts in the spring of 1924 to find some way of treating the water used in the closed cooling systems so that no damage or loss of time would be suffered through scale and corrosion. This proved to be a very difficult problem and required considerable time and the best efforts of the technical staff. A search of the literature revealed a number of references to certain substances which in solution inhibit corrosion. A number of tests were made, following the method outlined by Cushman and Gardner in 1910 which indicated that two pounds of potassium dichromate, or two gallons of sodium silicate, per 1000 gallons, would inhibit corrosion.

Tests Made

In carrying out these tests a number of oil sample bottles were prepared and several were filled with water from each sample to be tested, dichromate was added to all but one and a new 10-penny nail placed in each bottle. By varying the amount of dichromate added to the bottles containing water from each sample, and by running duplicate sets, one at much higher temperature than the other, data were obtained for a wide variety of conditions. In those tests in which natural, condensed, or treated waters were used, without the addition of any dichromate, corrosion of the nails started in a very short time, the higher the temperature the quicker and more vigorous the action. It was found that even very small amounts of dichromate exercised a retarding influence, and when the proportion reached two pounds of dichromate per 1000 gallons of water corrosion was practically inhibited. Such nails could be left in the solution in open bottles for months without showing any effects of corrosion aside from a slight tendency in some tests on the sharp edges.

Tests were made at that time at one of the booster stations which indicated that the use of dichromate was beneficial, but at the Cooper plants a much more extended test was made with the sodium silicate. The latter proved efficient as an inhibitor of corrosion. and was quite satisfactory so long as condensed water was available, but when the available condensed water was insufficient and hard water was turned in, a heavy deposition of sludge occurred, which in a comparatively few months became so serious that the use of silicate was abandoned.

The sludge formed under these conditions consisted largely of gelatinous silica. A brief study of the reactions between the silicate and the scale-forming constituents of the water reveals the reason for the deposition of the silica. For example, the reaction with calcium sulfate is as follows:

$$CaSO_4 + Na_2O.SiO_2 = CaSiO_3 + Na_2SO_4$$

Since in the silicate used the ratio of sodium oxide to silica is 1:3.25, it is evident that 2.25 parts of silica must precipitate for each part usefully employed. Incidentally, this explains why sodium silicate is not an efficient agent for treating water which is under ordinary conditions of temperature and pressure.

Potassium Dichromate

As the results of the use of these inhibitors were quite encouraging, the laboratory staff was asked, late in 1924, to resume work on the problem and devote all possible time to it until a satisfactory solution was developed. Since it seemed out of the question to use sodium silicate under all the conditions which were likely to arise, an extended inves-

(Continued on page 98)

Chemical Control at Treating Plant

By L. J. CATLIN
The Standard Oil Company of Kansas

THE relation of the laboratory to the operating department is a complicated affair, to say the least.

Any manufacturing problem has three more or less distinct phases, whether the industry be a one man industry, or whether its functions are carried out by an organization with highly specialized departments.

There is the technical phase, the executive phase, and the operative phase. Or we might say, the fact, the plan, and the manipulation. In an organization these may be more or less specialized and localized in the laboratory, the office, and the plant, but they can by no means be segregated. Someone with a good sense of rhetoric and rythm tries to "sum up" the whole proposition by saying, "Knowledge is knowing what to do next; skill is knowing how to do it; virtue, is doing it."

But there is a lurking danger in the rythmic triads, for we always have a tendency to insinuate that "The greatest of these is No. 3"; and it doesn't take much experience in a business organization, or any other organization, to learn that the moment any department, or individual representing a department, injects that issue, the old machine soon develops a squeak which represents inefficiency. For this reason we hasten to explain that the title to this article does not infer "chemist" control, or "laboratory" control of the treating plant foreman's private affairs, and most certainly the word "control" does not infer the assumption of executive prerogatives by a technical department. Anyway, organization is a local problem, but the chemical nature of the treating problem is universal.

Chemical control, of course, necessitates a knowledge of the chemical reactions involved, and during the last few years research has thrown a great deal of light upon the nature of impurities removed by treatment, and the reactions involved in their elimination. This is especially true of these classes of compounds reacted upon by caustic, or alkaline solutions.

In general, there are two types of tests available for chemical control. The one tests the oil, is more or less qualitative, and shows the results of treatment compared with certain standards. For example the doctor test, or color test, applied either to the oil directly, or to a steam-distilled fraction of the oil. The other type of test is applied to the reagents, is quantitative in nature, and refers more especially to the economics of the process, and the complete utilization or restoration of reagents. The second type of test is likely to be a laboratory problem and is the one to be discussed in this article.

Alkaline Solutions

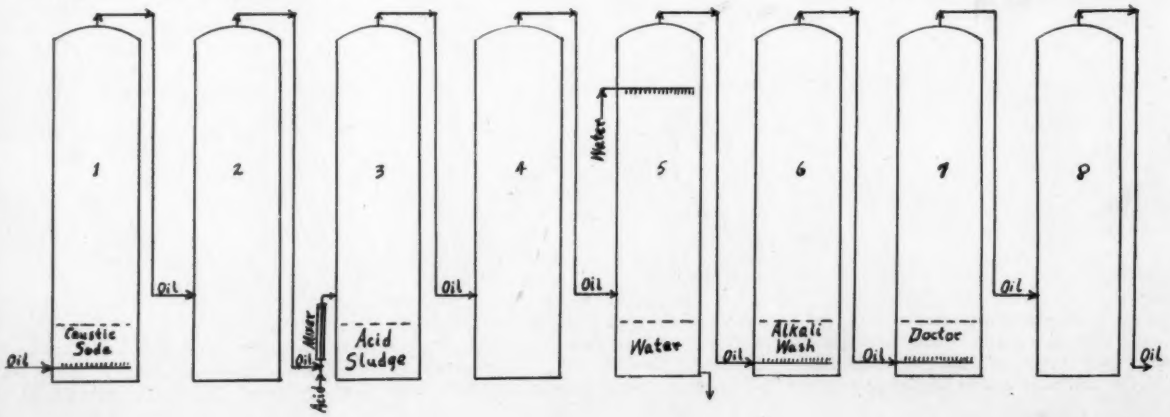
In ordinary systems of continuous or batch treatment, caustic, or alkaline solutions may perform several functions, and it has been found that if these are carried out separately, the life of the caustic may be considerably extended. This is obvious when we consider that any solvent, or reagent, taking two or more impurities from the oil, may become saturated, or exhausted, with respect to one, long before its usefulness is exhausted with respect to the others; and yet its use will be limited by the first factor unless they are segregated. Such segregation is perhaps most easily applied to continuous systems, where the various steps in the treatment are each confined to one or more towers, and the caustic remains in the tower in which it is used till exhausted for that particular operation. Caustic soda is the one generally used.

The various reactions of caustic soda, or, to use its chemical name, sodium hydroxide, may perhaps best be discussed by considering a system in which its different reactions are segregated. We may describe it in its simplest form as a continuous system in which the oil is pumped serially through eight towers as in Figure 1.

The treatment is as follows:—Tower No. 1, straight caustic wash; No. 2, settling; No. 3, acid treatment and sludge settling; No. 4, sludge settling; No. 5, water wash; No. 6, Alkaline wash; No. 7, doctor; and No. 8, settling.

In No. 1 tower, the principal reaction is the removal of hydrogen sulfide by the reaction, $2NaOH+H_2S = Na_2S + 2H_2O$. This reaction may be carried still farther as follows, $Na_2S+H_2S=2NaHS$, and the amount of H_2S removed from the oil in the last step is equal to that removed in the first step; but before the second reaction proceeds beyond about 1/3 the theoretical total, it becomes so slow that not all of the H_2S in the oil will be removed. Under certain conditions it might be profitable to introduce another step ahead of No. 1 tower, in which caustic almost spent in No. 1 might be used till completely exhausted according to the second step in the reaction, using fresh caustic in No. 1 to complete the removal of the H_2S. Other substances removed by this caustic wash, are the tar acids*, and a small portion of mercaptans. It is probable that these are simply held in solution and the saturation point as far as the tar acids are concerned, is somewhere near the point where the first part of the reaction is 90 per cent completed. When the second part of the H_2S reaction is about one-half completed the tar acids are precipitated from their caustic solution and are taken up again by the oil. This tends to limit the applicability of the pre-wash ahead of No. 1, but if some tar acids do pass this point they will be caught later so they need not be given primary consideration at this point.

The next point where sodium hydroxide appears in the system is in No. 6 tower, where it is used as a neutralizing wash ahead of the doctor treatment. The importance of this wash arises from the fact that the prime function of sodium hydroxide in doctor is as a carrier for lead, or litharge, and anything which neutralizes its caustic properties, lessens its ability to carry lead. The reactions in No. 6



[1]Ind. & Eng. Chem. 16, 587 (1924); also 18, 743 (1926). Refiner & Natural Gas Mfg. Vol 5, No. 4, (1926).
[2]Ind. & Eng. Chem. 16, 1113 and 1116 (1924).
[3]Refiner, Vol. 5, No. 9, Sept., 1926.
[4]Refiner, Vol. 5, No. 5, May, 1926.

depend upon several things. In the first place the completeness of acid removal by settling in Nos. 3 and 4, and the water wash in No. 5. If any sulfuric acid carries over we will of course have the reaction, $2NaOH+H_2SO_4 = Na_2SO_4+2H_2O$. But this should be of minor importance. In the second place it depends upon whether there is a chance for gasses to leave the system at the top of No. 5 tower. Assuming a completely closed system, and a proper water wash in No. 5 tower, we have a reaction taking place in No. 5 which so far as we know, is seldom taken into consideration in treating systems of this sort. Natural waters always carry bicarbonates and using calcium as an example we have the following reaction with any sulfuric acid carried over from No. 4 tower:—$H_2SO_4+Ca(HCO_3)_2 = CaSO_4+2H_2O+2CO_2$. The important reaction in No. 6 now becomes, $2NaOH + CO_2 = Na_2CO_3+H_2O$; and like the reaction with H_2S, may be carried twice as far by completing the reaction, $Na_2CO_3+CO_2+H_2O = 2NaHCO_3$. Here again the slowness of the reaction limits practical operation to a point where the second stage of the reaction is about one-third completed. In practice the wash in No. 6 may be any alkaline solution that will take up CO_2, such as discarded doctor solution from this system and other systems, provided it has not been allowed to take up H_2S; and recent experiments by the author indicate that when other inexpensive forms of sodium hydroxide are lacking, hydrated lime, $Ca(OH)_2$, which costs only about one-third as much as fresh caustic soda, may be used by adding it to the spent caustic soda in the tower. Hydrated lime alone presents a problem of a low degree of solubility and the necessity of agitation. When introduced with spent soda it renews the soda by the reaction, $2NaHCO_3+Ca(OH)_2 = CaCO_3 + Na_2CO_3 + 2H_2O$. The $CaCO_3$ becomes a precipitate which may tend to clog the system unless the reaction is continued to the point where all the $Ca(OH)_2$ is exhausted and the excess CO_2 redissolves the $CaCO_3$ according to the equation, $CaCO_3+CO_2+H_2O = Ca(HCO_3)_2$. This point has not yet been definitely determined.

Possibility of Releasing Gases

One other point, however, seems worthy of mention at this point, and that is the possibility of releasing from the system the gases which accumulate as a result of the water wash. In June, 1926, the author made a test by drawing a sample from a small valve connected in the side of the line coming from the top of No. 5 tower, and entering No. 6 at the bottom. It is hardly to be presumed that the sample completely represents conditions in the line, but this is what the sample showed: For three parts of oil collected there was one part of gas, which on analysis was found to be 1.5 per cent CO_2, 55 per cent air, and 43.5 per cent oil vapor or gas. The case came to attention by the fact that the line in question, as well as the upper part of the water wash tower, showed considerable evidence of corrosion not noticeable even on lines carrying dilute acid wash, and might be attributable to the corrosive action of oxygen, in the presence of the weak acids. The presence of so much air at this point is a little difficult to understand, but presumably a large part of it enters with the water, and is quite effectively trapped at this point. The fact that corrosion of the line is most pronounced where the liquid flow is downward, and scarcely noticeable in the same line after its horizontal and upward turns, seems to prove that trapped gases have something to do with it.

Doctor Solution

The most important reaction of sodium hydroxide in the doctor solution is its reaction with litharge to form the soluble plumbite, and the subsequent reaction of this plumbite with the mercaptans. The fact that it is merely a carrier for lead is brought out by consideration of the generally accepted equations for the reactions, which show that after the second reaction the sodium hydroxide is restored to its original form without loss. Using ethyl mercaptan as an example these equations are as follows[2]:— $2NaOH+PbO = Na_2PbO_2+H_2O$; $Na_2PbO_2+2C_2H_5SH = (C_2H_5S)_2Pb+2NaOH$; $(C_2H_5S)_2Pb+S = (C_2H_5S)_2+PbS$.

Viewing these reactions from the standpoint of the doctor we start with sodium hydroxide and litharge, and end up with sodium hydroxide and lead sulfide. Many treating systems today are operating on the basis of the principle that the usefulness of doctor for sweetening is not exhausted when these reactions have been completed, but that the precipitated PbS, or "black strap," itself is very effective in the removal of mercaptans, either by absorption or as a catalyzer for some other reaction. Some go so far as to precipitate a large amount of this in the doctor by the use of hydrogen sulfide before attempting to use the doctor, taking care not to use any more H_2S than the lead requires for precipitation, thus avoiding any neutralization of the sodium hydroxide. As fast as lead is thus removed by precipitation it may be renewed by adding litharge to the sodium hydroxide, till the required amount of precipitate, or "black strap" is formed. Regardless of which view we take of the sweetening reaction, the fact remains that the sodium hydroxide must be kept up in order to perform its function as carrier for the lead. In actual practice it has been found that with proper protection for the sodium hydroxide as shown in the discussion of No. 6 tower, a doctor solution will remain effective for months in No. 7 tower, with perhaps occasional addition of litharge.

Chemical tests on the doctor solution must show the condition of the sodium hydroxide and the amount of lead in solution. In this connection it may be mentioned that experience has shown that a low percentage of lead in solution is more stable than high percentages, since the higher amounts, that is above one per cent, tend to form emulsions, carrying the lead over in the oil, perhaps in the form of lead mercaptide, which is shown in sweetening reaction when the oil turns reddish brown, just before the "break" in the reaction. In such a case the only recourse is the addition of large quantities of sulphur, which is injurious, and avoidable with lower percentages of lead in the doctor. A good working range is from .2 per cent to .75 per cent Pb. in doctor of about 15 degrees Be. gravity.

Sulfuric Acid

As to the reactions with sulfuric acid, less has been published which is applicable to routine control, but the prominence of the question of antiknock proprties of gasolines is most certain to cause more research along these lines. Gravity tests are of course readily applied at the treating plant, but when restored acid is used these may not always check with acidity tests. Acid heat tests on the oil may be useful, as well as color tests on steam-distilled fractions of the treated oil; but until more is known concerning best operating conditions for acid, and more known of the fundamental reactions, laboratory tests for control purposes will be limited.

Tests on Caustic Solutions

The following tests furnish the information necessary for purposes of control as outlined with regard to the caustic soda solutions previously discussed.

1. Alkalinity tests. These tests are made with a sulfuric acid solution, using methyl orange and phenolphthalein indicators. The strength of these caustic solutions is determined by gravity when they are made up so the main thing we need to be concerned with is their percentage "spent" according to the various reactions. In No. 1 tower we test for hydrosulfide, sulfide, and hydroxide; in No. 6, for bicarbonate, carbonate, and hydroxide; and in No. 7 for the same as in No. 6, and in addition test for lead in solution.

Reagents—Sulfuric acid, made by adding about 5 c.c. C. P. acid to 1000 c.c. distilled water.

Phenolphthalein, about .2 gm to 100 c.c. alcohol.

Methyl orange, about .2 gm to 100 c.c. distilled water.

Making the test.—Filter the caustic solution. Take about 8 or 10 drops as a sample in a beaker, and add about 25 c.c. distilled water. Add one drop phenolphthalein indicator. Titrate with sulfuric acid till the red color disappears, and read accurately the number of c.c. of acid used. Now add one drop of methyl orange and continue the titration till the yellow color changes to an orange tint, and read the total number of c.c. of acid used in both parts of the titration. If we call the number of c.c. for the first part P, and the total number used T, we may now express the perecentage "spent" in the formula, per cent $= \frac{T-P}{T} \times 100$. In this formula we assume the caustic to be 100 per cent spent when it is completely converted to sodium hydrosulfide, or bicarbonate. The normal sulfide and carbonate will be represented when the alkalinity shows 50 per cent spent.

2. Lead in Doctor. The molybdate method[3] is used for the determination of lead, especially with low percentages. If higher percentages are used it may be convenient to use the sedimentation method[4].

Caustic Soda Dissolution Made Safe and Economical

Producers and Refiners Corporation plant at Parco has convenient and efficient method and layout

By H. L. KAUFFMAN

IN the refining of both light and heavy oils, chemical treatment in most cases is an essential step in the refining process. Gasoline, kerosene, naphtha and similar distillates representing the lighter fractions of the crude oil are usually roughly classified as "light oils"; while the lubricating oil fractions are generally designated as "heavy oils."

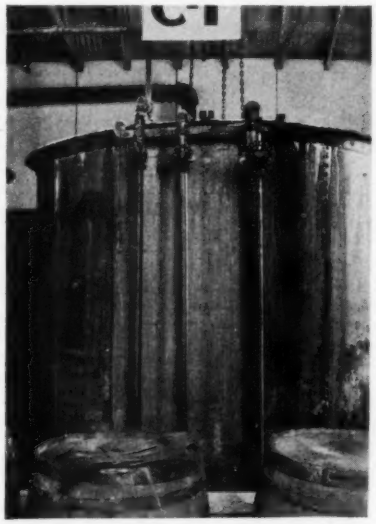
With the exception of the fractions obtained from certain crude oils found mostly in the Pennsylvania fields (that is, most of the paraffin base crudes), the chemical treatment usually given "cuts" from asphaltic and mixed based crudes generally involves a treatment of the oil with varying amounts of sulphuric acid, followed by neutralization with a solution of either caustic soda or soda ash.

In the treatment of gasoline obtained by the primary distillation of certain crudes, if any chemical treatment whatsoever is necessary, a treatment of the oil with sodium plumbite solution (co-called "doctor" solution) is the only chemical treatment needed to make a finished, marketable product. Incidentally, at the present time, the distillates coming from the bubble towers of many of the more efficient cracking processes are of such a nature that, providing the crude also is of relatively low sulphur content and otherwise possesses suitable characteristics, a finished gasoline can be obtained merely by a doctor treatment of the distillate; as compared with previous proceedings when an acid treatment and neutralization of the distillate was required, and sometimes (especially if the distillate was re-run) even a second finishing treatment of the gasoline with doctor solution before it was a proper quality to be pumped to storage.

What Doctor Is

Doctor solution is a solution of litharge (lead oxide) in caustic soda (sodium hydroxide). Litharge is only slightly soluble in a solution of soduim hydroxide—only about three per cent of litharge dissolving in 30 degree Baume gravity sodium hydroxide solution. Litharge is effective in treating oil (and thus removing objectionable sulphur compounds) only in the peculiar state of combination in which it exists in solution in sodium hydroxide, namely, as sodium plumbite, so that a great excess of litharge is simply waste. In making up doctor solution, however, it is usually beneficial to have present a slight excess of litharge. This, then, insures the saturation of the sodium hydroxide, and, when same is applied to the oil undergoing treatment, causes to be obtained any possible precipitating effects of the suspended litharge.

In addition to the use of caustic soda in making doctor solution, which, as has been mentioned is used mostly in the treatment of light oils, caustic soda solutions of various strengths are also used in neutralizing both light oils and lubricating oils that have been given a prior treatment with sulphuric acid.



Close-up of caustic soda dissolving tank.

Further, in some cases (such as in the treatment of distillates containing a relatively high percentage of naphthenic compounds) an initial treatment of the oil with a solution either of caustic soda or doctor solution, followed by the regular acid and soda treatment, gives a finished product of a quality that cannot economically be made otherwise.

It is not the purpose of the writer either to describe or to discuss in this brief article any of the numerous methods followed in treating light or heavy oils or of the principles and chemical reactions involved therein. However, the interested reader will find a full discussion of these phases of the subject in Morrell and Egloff's articles, "Refining Cracked Distillates vs. Light Oils" (The Refiner and Natural Gasoline Manufacturer, Volume II, No. 7, July 1923) and "Various Methods of Refining with Especial Reference to Cracked Hydrocarbon Oils" (The Refiner and Natural Gasoline Manufacturer, Vo. II, No. 9, September, 1923).

Caution Necessary

Brief mention was made in preceding paragraphs of the usual features of chemical treatment merely to show the reader that caustic soda *is* an important chemical used by the refiner in the chemical treatment of oils. Hence, because of this fact, the refiner is interested in handling this chemical conveniently and efficiently whenever it becomes necessary to make up a solution of caustic soda.

Caustic soda is usually bought by the refiner in iron drums weighing 400 to 450

Caustic soda dissolving tanks.

Arrangements for inserting sulphur in the system, suction at top and discharge at bottom.

lbs. Because of the injurious effect of caustic lye upon the skin of the worker, and particularly its dangerous effect upon the yes, great care must be taken by the person opening caustic soda drums to prevent any chips of caustic or any caustic dust from getting either upon the skin or in the eyes.

The writer has seen numerous methods of opening caustic soda drums: some efficient, and having in mind the safety of the worker, some inefficient and inconvenient and with constant danger to the eyes of the worker. In a number of the smaller refineries, a method sometimes used is to cut in the head of the drum with an ax and then either dissolve the solid caustic with steam and hot water, or attempt to break into pieces the solid caustic. Unless efficient equipment is provided for handling and dissolving the caustic, the workman is in constant danger of lye burns, and such accidents *are* numerous in many refineries.

Safety Assured

How Producers & Refiners Corporation at their Parco, Wyoming, Refinery provided a convenient and efficient method (incidentally, the lay-out was comparatively inexpensive) for dissolving caustic soda will be described in this article. At this refinery light oils are treated both in a light oil continuous treating plant and in batch agitators. All gasoline is given a doctor treatment before it is marketed; while all pressure distillate obtained from the Dubbs Plant is treated with sulphuric acid and thereafter neutralized with a solution of caustic soda.

At one end of a building housing the towers and lines of the continuous light oil treating plant, and connected by doorways thereto, there was erected at the Parco Refinery a building (made of galvanized sheet-iron) for housing five caustic soda dissolving tanks, two small pumps and connecting lines; and also providing ample space for such litharge and caustic soda drums as are needed at any one time in making up solutions of caustic soda or doctor. This building is approximately 30 ft. wide by 40 ft. long.

The main caustic soda dissolving tanks are about 6 ft. wide by 6 ft. deep, and have a capacity of approximately 1300 gallons. They rest upon a concrete foundation and are surrounded by a concrete dyke, which is about 18 inches in height, and in which are placed all connecting pipe lines. A fifth tank, approximately 6 ft. wide and 4 ft. deep, and having a capacity of a little over 900 gallons, is used in making up doctor solution, or for any other miscellaneous uses.

Above the center of all tanks is supported firmly in place a steel rail, to which is attached a block and tackle. By this pulley and chain arrangement it is possible for one man to raise and to lower into the dissolving tank a drum of caustic soda (the drum previously having had openings made in it with an ax) without any danger of lye burns whatsoever to the worker, and with absolutely no waste of caustic soda. The hot water in the dissolving tank dissolves out all the caustic from the drum, and while this is taking place the worker is free to go about his other duties. By calculation, and from previous experience, the operator knows how many drums (pounds) of caustic dissolved in a definite number of gallons of water will give a caustic soda solution of the strength desired and so the worker definitely controls the amount of water that he places in each tank.

Each of the larger tanks is provided with an air and a steam line; a water line, and a pumping-out line.

A wooden track is placed around the concrete dyke, so that the iron caustic drums can be rolled about more easily—thus facilitating their handling.

Advantages

When a caustic soda solution of the desired strength has been made up, it is thereafter either used to make doctor solution and as such mixed with gasoline to "sweeten" the gasoline; or it is used in the form of regular lye solution to neutralize cracked distillates following the acid treatment.

To the refiner who desires to improve existing methods and equipment for dissolving caustic soda as in use in his refinery, the writer would recommend, unhesitatingly, the procedure and equipment for carrying out this work as in use at the Parco, Wyoming, Refinery of Producers & Refiners Corporation, and herein briefly described and illustrated, and this because the layout is (1) relatively inexpensive; (2) is convenient for the worker, efficient (no loss of caustic) and gives a neat-looking, rather than the usual sloppy appearance to that particular part of the refinery; and (3) gives the greatest possible assurance to the workman that he is not constantly in danger of caustic burns when making up either caustic soda or doctor solution, and an equally great assurance to the refiner that he, himself, is doing all that he possibly can for the safety and welfare of his employee.

Pipe arrangement for caustic soda dissolving tanks.

Fig. ?? shows the method provided for introducing sulphur into both the suction and discharge side of the pump when treating light oils continuously at the continuous light oil treating plant of Producers & Refiners Corporation's Parco, Wyoming, Refinery.

Indiana Company Files Patent Suit

Chicago, Ill., Jan. 19.—The Standard Oil Company (Indiana) has filed suit in the United States District Court at Hammond, Indiana, against the Bartles-Mcguire Company and the Graver Corporation charging the infringement of nine patents owned by the Standard Oil Company. The Patents involved, cover a period of nine years from August 4th, 1914 to March 13th, 1923.

The Bartles-Maguire Company, headquarters are in Milwaukee, Wisconsin, while the Graver Corporation has its offices in East Chicago, Indiana. The Bartles-Maguire Company is engaged in the marketing and refining of petroleum. This company is licensed under the Jenkins Cracking Patents and the Graver Corporation constructs and installs the apparatus for the practice of the Jenkins Process.

The names, dates and numbers of the patents are as follows:

Name	Date	Number
Burton	8-4-14	1105961
Clark	12-1-14	1119496
Humphreys	12-1-14	1119700
Burton	11-16-15	1160689
Burton	1-11-16	1167884
Cash	6-12-17	1230065
Humphreys & Burton	6-15-20	1343674
Clark	8-23-21	1388514
Burton & Clark	3-13-23	1448254

Cooling of Absorption Oil at Gasoline Plants

Discussion of efficiencies of cooling coil types based on experiments conducted at California plants

By E. R. COX

(From a paper read before the California Natural Gasoline Association September 23, 1926. It treats only of one phase of oil cooling, and is to be followed by papers on shell and tube coolers, and combinations. If we carry the cooling to a nearer approach to wet bulb temperatures, the advantage of the atmospheric coil type of cooling tends to disappear and the advantages may finally be with the other type. Mr. E. R. Cox is engineer with the California Gasoline Company.)

TWO METHODS are commonly used to cool the absorbent oil in natural gasoline absorption plants. One is to use tubular coolers in which the water is circulated through the tubes and the oil in counterflow through the shell space. Frequently, special devices, some patented, are used to increase the turbulence of the oil. The transfer rate is from 60 to 80 B.t.u. per square foot per degree per hour for clean tubes, and it drops rapidly to about half these values with the accumulation of scale. The other method is to circulate the oil in a pipe coil located in a cooling tower or spray pond, or to drip water over a stand of pipes, as is done in ammonia condensing. If the temperature of the water is measured, when striking and leaving the coil, and the transfer rate is calculated in the ordinary manner, this temperature is considerably lower than in tubular coolers, varying from 10 to 30 degrees. The advantages lie in lower cost of surface, lower temperatures attained, and less trouble from scaling.

Plant Tests on Cooling

With these considerations in view, a plant was built to cool crude oil from a dehydrating plant. The data are shown in the accompanying table, Test "C". Water, at the rate of 150 gallons per minute was first cooled from 75 degrees to 64 degrees in a Fluor cooling tower, 12 feet by 12 feet by 30 feet high, then sprayed over the coil through sixteen No. 15 N. Y. Cooling Tower Company spray nozzles, and thence pumped back over the tower. The coil consisted of 5760 feet of two-inch standard pipe, arranged in four coils of 36 lengths, each 40 feet long. These were laid in two layers, staggered, 2 feet 6 inches from the floor The coil was surrounded by a corrugated iron fence 26 feet by 42 feet by 13 feet 6 inches high, open 3 feet 6 inches at the bottom. Three feet outside of this was placed an apron 3 feet 6 inches high to catch the drift. Crude oil, 26 degrees Be, at the rate of 4500 barrels per day was cooled from 161 degrees to 91 degrees F. As an experiment, the cooling tower was cut out, and the water merely recirculated through the sprays. The temperature of the pond water rose to 82 degrees but that of the oil rose only four degrees, namely from 91 degrees to 95 degrees. Believing that adequate cooling could be obtained by the coil and spray pond alone, this plan was adopted as the standard for adsorption plants.

The coils are made up as grids, each consisting of eighteen 1¼-inch pipes, 20 feet long, welded into a 6-inch header at each end. The headers are provided with nozzles on alternate sides, at each end, so that when bolted together the grids stand up at an angle of 60 degrees, and are all in series. The spacing of the pipes, projected to the horizontal, is 1¼-inch centers throughout, so that no drops can fall between them, and each pipe receives cold water. At the same time, ample air lanes are left between grids for ventilation. The bottom of the grids is 2 feet 6 inches from the floor. They are enclosed on one end and one side only, by a fence 16 feet high, open 6 feet from the ground. The water is sprayed through 19 No. 10 N. Y. cooling tower nozzles and is circulated by a Worthington 7½x8½x6 inch Duplex pump, running at 20 r.p.m. Two of these cooling ponds were built for sub-cooling oil at old plants where the regular cooling was inadequate. The results are given under accompanying tests "B" and "C."

How Rating is Facilitated

Difficulty has always been encountered in rating the performance of open coils of this sort and comparing one with another, through not knowing the temperature of the water film upon the coil, and not being able to predict the condition for a given design. To obviate this difficulty, the following method has been devised and seems to give quite consistent results. It is based on assuming that the problem is not one of simple conduction (in which the temperature of the water films would need to be known) but that it is a complex process of conduction and evaporation. Tests "B" and "C" indicate that the results are not consistent if analyzed from the standpoint of atmospheric temperature alone, or from that of wet bulb alone, but that the cooling is a function of both temperature and humidity. Assume that the atmospheric temperature is the controlling factor at the hot end of the coil and the wet bulb at the cold end, since if the coil were indefinitely extended this would be the limiting temperature to which the oil would be cooled. Calling the oil temperatures in and out T_1 and T_2, and dry bulb and wet bulb t_1 and t_2 respectively,

$\Theta_1 = T_1 - t_1$ and $\Theta_2 = T_2 - t_2$. If Θ_1 is not more than 1.5 times Θ_2, $\Theta M = \frac{1}{2}(\Theta_1 \div \Theta_2)$. If the ratio is larger,

$$\Theta M = \frac{(\Theta_1 - \Theta_2)}{\log_e \frac{\Theta_1}{\Theta_2}}$$

was calculated for both arithmetical logarithmic values of Θ_m, the latter indicated by $\Theta^1 m$. They are 1.02 and 1.06 respectively for "B" circulating 255 g.p.m., and 1.05 and 1.11 for "C," circulating 192 g.p.m. of absorbent oil, 32.5 degrees (Be.) and 33.5 degrees (Be.) respectively. In each case hourly readings were taken and these averaged for the 24 hours. The results are shown in tests "B" and "C."

Δ/Θ_m is evidently affected more by atmospheric conditions than by the velocity of the oil. The weather was fairly normal during test "B" and there was considerable rain during test "C." The fact that under a wide range of weather conditions the value of Δ/Θ_m remained so nearly constant would indicate that $\Delta/\Theta_m = 1$ would be a safe basis for design.

In order to ascertain whether Δ/Θ_m is a straight line function of the length anohter reading was taken to determine the temperature at the middle of the coil. This showed 8 degrees out of 13 degrees, or 61.5 per cent, of the cooling in the first half of the coil. If the straight line relation existed, Δ/Θ_m should be one-half the values shown, for half the coil length, or .51 and .53 respectively. The arithmetical means are taken because this allows the middle temperature to be readily calculated. These are 75.3 degrees and 72.1 degrees, which would be 60 per cent, and 59 per cent cooling in the first half. This checks within 1½ per cent or 0.33

degrees with test—well within the experimental error—and confirms the straight line assumption. The formula for 1¼-inch pipe would then be (L=600). $\Delta/\theta_m = L/600$.

In order to ascertain the effect of diameter of tube, the known performance of other coils is used although dry bulb and wet bulb temperatures are not known for these tests. However, they were all made in the same district, Los Angeles County, within five miles of the ocean and under average weather conditions. Under such conditions, temperature and humidity are quite uniform and it is believed that no substatial error is involved in assuming approximately the conditions for test "B," that is, 64 degrees dry bulb and 58 degrees wet bulb.

If $\frac{\Delta}{\theta_m} = \frac{L}{C_1}$, then $C_1 = L\frac{\theta_m}{\Delta}$,

And if $\frac{\Delta}{\theta_m} = \frac{L}{C_2 d^n}$

then $C_2 d^n = C_1$ or $C_2 = C_1/d^n$.

C_1 was calculated from the above relation and plotted against the outside diameter of the pipe, upon logarithmic paper. Except test "A," which was for crude oil, and an arrangement which probably did not allow sufficient ventilation, the points lay on a straight line with an exponent n=1.5

Dividing C_1 by $d^{1.5}$, C_2 is found and the results are as shown in Table D.

This shows excellent agreement for absorbent oil and the formula for this type of cooling would be:

$$\frac{\Delta}{\theta_m} = \frac{L}{260d^{1.5}}$$

$$L = \frac{260d^{1.5}\Delta}{\theta_m}$$

The size of pipe, or number of pipes in multiple, must be determined by pressure drop considerations.

Where the oil is to be cooled through the entire range required in absorption plants (as in D), two coils, located in separate ponds, are connected in series and the water circulated, independently over each. This gives colder water for the final cooling. The gasoline condensing coils are also divided between the two ponds, jacket-water cooling coils are placed in the cold pond, and gas intercoolers and aftercoolers in the warm pond. The oil-cooling coils consisted of five 1¼-inch pipes, 600 feet long, in each pond. The temperatures realized were 134 degrees to 67 degrees at 29 g.p.m. and 139 degrees to 70 degrees at 48 g.p.m.

In order to compare spray pond cooling with surface coolers and a tower, the case "B" is taken with the following assumption:

Oil: 255 gal. per min. (or 108,000 lbs./ hr.), 85 degrees—68 degrees.
Water: 167 gal. per min. (or 83,500 lbs./hr.), from 64 degrees to 75 degrees.

Cooling tower: to handle 15 gal. per min. lineal foot and cool from 75 degrees to 64 degrees with wet bulb at 57 degrees F. and costing $100 per lineal foot.

Surface cooler: to have a transfer value of 70 B.t.u. per square foot per degree per hour, and to cost $2.50 per square foot.

Heat to be removed: 108 000 (lbs.)X 17 (°)X.5 (sp. ht.)=918,000 B.t.u./hr.

Surface required:

$$\frac{918{,}000}{70 \text{ (transfer rate)} \times 6.55 \text{ (mean temp. diff.)}} = 2000 \text{ sq. ft.}$$

Tower cost: $\frac{167 \times 100}{15}$ = . . . $1110.00

Coolers cost: 2000x2.50 = ...	5000.00
Total	$6110.00
Spray pond	1330.00
Cooling coils	3450.00
Total	$4780.00

Assuming that the cost of pumps, piping and other equipment offsets, the advantage of the spray pond is $1330. The principal advantage, however, lies in avoiding the expense and shutdowns involved in scaling the tubes of surface coolers.

There is another advantage in the smaller quantity of water required, 120 g.p.m. instead of 167. For 30 pounds pressure it requires four pounds of steam per hour, per gallon per minute, and the cost of the steam is $2 per year, per pound per hour, or $8 per year, per gallon per minute, for fuel alone. In five years this would amount to (167—120)x8x5=$1880 in favor of the spray pond. If less water is circulated the cost of cooling surface mounts rapidly.

To afford a basis of comparison, the cost of heating the water to 70, 75 or 80 degrees has been estimated as follows:

The advantage lies with the spray pond both in first cost (20 per cent.) and in total cost for one year (22.8 per cent), or five years (23.9 per cent), choosing the most favorable design for the tubular coolers.

Heating to	70°	75°	80°F.	Spray Pond
Cost of Coolers	$ 3930	$ 5000	$ 7280	$ 3450
Cost of Tower	2040	1110	760	1330
Total first cost	$ 5970	$ 6110	$ 8040	$ 4780
Cost of steam, one year	2450	1330	910	960
Cost of steam, five years	12250	6650	4550	4800
Total cost, five years	$18220	$12760	$12590	$ 9580

Test	Coil Dia.	Length	T_1	T_2	$\frac{\Delta}{\theta M}$	C_1	C_2
A	2"	1440	163.	95.	1.075	1340	365
B	1¼"	600	85.4	68.6	1.063	563	263
C	1¼"	600	80.0	66.6	1.111	540	252
D	2"	2000	137.	69.	2.07	965	263
E	2½"	2250	135.	72.	1.79	1260	259

Data Test "B"

Date Mar.	Atm.	W.B.	Oil In	Oil Out	Δ	θ_1	θ_2	θm	$\frac{\Delta}{\theta m}$	$\frac{\Delta}{\theta m}$	$\frac{\Delta}{\theta m}$	G.P.M.
27 .	.62°	58°	84°	69°	15	22	11	16.5	.91	15.87	.947	256
28 .	.65	59	85	70	16	21	11	16.0	1.00	15.46	1.035	255
29 .	.64	57	86	68	18	22	11	16.5	1.09	15.87	1.135	253
30 .	.63	57	84	68	16	21	11	16.0	1.00	15.46	1.035	256
31 .	.64	57	87	68	19	23	11	17.0	1.12	16.28	1.166	258
Mean	63.6°	57.6	85.4	68.6					1.02		1.063	255

Data Test "C"

Date Apr.	Atm.	W.B.	Oil In	Oil Out	Δ	θ_1	θ_2	θm	$\frac{\Delta}{\theta m}$	$\frac{\Delta}{\theta m}$	$\frac{\Delta}{\theta m}$	G.P.M.
3 . .	.62	55	80	65	15	18	10	14.0	1.07	13.60	1.103	188
4 . .	.63	56	81	66	15	18	10	14.0	1.07	13.60	1.103	192
5 . .	.64	60	81	66	15	17	6	11.5	1.30	10.58	1.417	191
6 . .	.61	60	80	66	14	19	6	12.5	1.12	11.26	1.240	192
7 . .	.65	62	80	70	10	15	8	11.5	.87	11.12	.899	191
8 . .	.62	60	78	66	12	16	6	11.0	1.09	10.18	1.178	195
9 . .	.61	57	80	67	13	19	10	14.5	.90	15.56	.835	199
Mean	62.6°	59.6°	80.0°	66.6°					1.06		1.111	192

Oil From Coal Not Now Practical, But Possible

Europeans, having no crude oil, consider it patriotic duty to find substitutes

By ISMAR GINSBERG

THE petroleum industry has heard much in recent years of the efforts that were being made abroad by various nations to free themselves from the need of purchasing motor fuels, lubricating oils and other mineral products from foreign countries, amongst which not of the least importance by any means has been the United States, and thus avoid having to send large sums of money out of the country in payment for these purchases or in other ways becoming subject to bad trade balance. We have looked upon these endeavors with a great deal of academic interest, and perhaps with considerable skepticism as well. Our knowledge of the economics of the oil industry in our own country and of general technical conditions in our own industry and in those industries that might become our competitors has led us in the past to conclude that these attempts were abortive and could scarcely affect us here.

It is safe to say that the average oil man of today has changed his opinion about this matter. While he does not yet believe that this development has reached such a stage that it can be introduced in a practical way in this country, he must now realize that great progress has been made on the other side and that the European nations, who do not have oil resources of their own, are thoroughly in earnest in their desires to get away from their absolute dependence on foreign sources for mineral oil products.

The motor fuels that are used in France and Germany to-day, for example, are no longer pure gasoline, but mixtures of gasoline and benzol and alcohol. The patent literature is full and keeps on filling up with all sorts of projects, mostly of a very highly imaginative character, suggesting the use of most anything that will burn in air as an ingredient of composite motor fuels. But the important underlying fact in all these efforts is that the country in question wants to get away from using gasoline for which it has to pay in gold, and expresses this desire in unequivocal terms and in fact surrounds it with a nationalistic and patriotic atmosphere, so that it becomes the sacred, patriotic duty of the citizen to use as little gasoline and the like as possible. He is urged and is indeed convinced that he owes it to his country not only to use the national fuel, Carburant Nationale, as it is called in France, but also to interest himself in developing processes and the like which might make his country still less dependant on foreign sources of mineral oil products. Thus it is not surprising to find such a flood of patents on composite motor fuels.

Just before proceeding further, we might say that it was our original thought to call this article synthetic gasoline, but while gasoline is of course the principal product involved in this evolution, nevertheless there are also others such as lubricating oil which deserve consideration. Furthermore the first step in the process is not the synthesis of a gasoline but rather of a petroleum from which gasoline is then distilled in the ordinary manner. Hence we are concerned with the production of synthetic petroleum.

Stupendous Task

Those who have seen an oil well spout out thousands of barrels of oil a day and who know that it takes many such wells to supply the country's consumption of mineral oil products in a single day, understand well how huge an enterprise must be to supply these products by a synthetic process. It has sometimes been suggested that alcohol could take the place of gasoline in the internal combustion engine, but careful economists and technologists will tell you that it would not be possible to set aside enough cultivated land for growing the cereals from which the necessary quantity of alcohol could be made without seriously disturbing the food resources not only of this country but of the world. If oil supplies will eventually fail, if new fields are not found to take the place of those that are constantly petering out, if new sources of supply are to be drawn upon to take the place of gasoline and other petroleum products, it is manifest that the time to start is right now. Thus while we in this country might not have any immediate interest in the important developments that are taking place in Europe along these lines, particularly in the utilization of coal for the production of oil, we are or should be interested from the standpoint of the conservation of our natural petroleum resources.

Any successful process depends on the ease with which it is possible to secure supplies of raw materials. Any process which seeks to synthesize petroleum must have as its starting substance a product that is plentiful, that is cheap, that is conveniently located, that is easily handled and that can be worked up into the finished product with a high yield and with the least possible technical difficulty. The one product that possesses these characteristics far better than any other is coal, that is all sorts of coal with the exception of hard or anthracite coal, which could not be used anyway for this because of its high price.

Coal Best Product

Coal is the starting point in the manufacturer of synthetic petroleum and naturally of synthetic gasoline, as an ingredient of the synthetic petroleum. It is not a strange theory to use coal as the starting point in the manufacture of a finished fuel, for coal is the raw material from which that most finished and highest quality of industrial and domestic fuel is manufactured; we mean central station manufactured gas. In fact in the destructive distillation of coal by the so called low temperature process, which has had some vogue in England where the most work on it has been done, a certain amount of oil is produced. But the purpose of this process has been mainly to manufacture gas and a semi-coke or special form of solid fuel together with a special brand of tar, known as low temperature tar. The yield of oil is very small and the process could not supply the necessary amount of oil if the entire American coal production were treated in this manner every year. We have no lesser authority than Henry L. Doherty in making this statement.

Coal has however been used in very large quantities to make coal gas and water gas, and in fact gas manufacture forms one of the principal uses of bituminous coal to-day. We are most interested in water gas, which consists essentially of carbon monoxide and hydrogen, although small quantities of methane and higher hydrocarbons will also be found mixed with it, as well as dilutents such as nitrogen moisture and carbon dioxide. The use of water gas for the synthesis of hydrocarbons and alcohol was suggested a long time ago, and recently the chemical world was astounded by the successful working out of a process of making methanol, that is wood alcohol. From the scientific standpoint it is possible to make

carbon and hydrogen react to form hydrocarbons and then build up from these hydrocarbons to form more complex products and thus produce a synthetic gasoline or motor fuel. But a careful analysis of the proposition will show that this is not possible from an industrial standpoint. The patent literature reveals the fact that about twelve years ago the Badische Anilin und Soda Fabrik, one of the principal German dye works, patented the manufacture of gasoline or rather gasoline hydrocarbons from their elements. This process used carbon monoxide which was made to combine with hydrogen under high pressure and in the presence of certain catalysts to form hydrocarbons and alcohols. This marked the start of the work which later culminated in the synthesis of methanol from water gas. But the industrial synthesis of hydrocarbons by this process does not appear to be at all feasible.

Best Process

There remains just a single known process whereby it has been demonstrated that its application on a practical scale is feasible and indeed an accomplished fact. That process is the so-called liquification of coal by means of hydrogen. At the recent conference held in Pittsburgh, Pa., under the auspices of the Carnegie Institute of Technologists, which was concerned with the progress in the utilization of bituminous coal and which was attended by prominent scientists and technologists from all over the world, Dr. Frederich Bergius delivered a talk on the process that bears his name and that has for its purpose the synthesis of petroleum by the hydrogenation of coal. We wish to say here that we are indebted to his excellent paper for certain facts which are included in this article.

The use of hydrogen to produce new products by having it combine with certain substances is rather well-known. Thus cottonseed oil is treated with hydrogen, that is hydrogenated, and converted into a solid fat. In this case a solid is derived from a liquid. Hydrogenation is also made use of in the production of certain new solvents—comparatively speaking—known as tetralin, hexalin and decalin, the first and last being made from napthalene, a solid, and the second being made from phenol which is a solid at ordinary temperatures. But in the case in question, the action of the hydrogen is quite the reverse. For here hydrogenation of the coal produces a liquid, or it may be held that the gaseous hydrocarbons in the coal are converted into the liquid condition by addition of hydrogen. However that may be the important fact is that the treatment of the coal with hydrogen under pressure and in the presence of catalysts results in the formation of an oil which resembles petroleum.

To understand what happens in the liquification of coal the composition and the formation of coal must also be understood. Thus both natural coal and lignite are composed of two sorts of chemical compounds. One of these which is the carbonaceous part is derived from the cellulose and lignin parts of the plants that have undergone decomposition to form coal. The second portion or the bituminous part is derived from fats, albuminous material, resins, waxes and other similar materials. The carbonaceous portion containing hydrogen, carbon and oxygen, while the bituminous portion is composed of higher proportions of hydrogen and lower proportions of oxygen.

When the ratio between hydrogen and carbon is figured in an average coal, it is found to be about one to sixteen, but in a liquid oil it is one to eight. Thus it is easy to see that there is just half as much hydrogen in the coal per part of carbon as there is in the oil, and hence in order to convert the coal into an oil, it is necessary to double the proportion of hydrogen. The essential point is to save as much as possible of the hydrogen in the coal, for hydrogen is a rather expensive commodity.

Bergius therefore holds that distillation and synthetical processes of manufacturing oil from coal are not tenable. For they tend to drive the hydrogen out of the coal and some of it is lost. Furthermore in the synthetical process some oxygen is caused to combine with the carbon to form carbon monoxide. It is also established that the production of hydrogen means the consumption of coal or of energy and that for making one weight unit of hydrogen at least eight weight units of coke are necessary. The important point is therefore to conserve the hydrogen that is bound up with the carbon in the coal.

Difficulties Encountered

This principle is the basis of the Bergius process which is concerned with the direct hydrogenation and liquefaction of coal. It was first developed by Bergius in his laboratory in Hanover; Germany in 1913. The development of the method was no accident in any sense of the word but took a great deal of time and study. It was really based on the contention that coal contained a number of chemical compounds which could be made to absorb hydrogen under certain definite conditions. One point that appeared problematical right at the outset was whether it would be possible to make the apparently inactive or rather indifferent coal substance absorb hydrogen, that is combine with it. The work that was done in the synthesis of ammonia from its elements and also in the hydrogenation of oils to obtain fats indicated the path along which further research should be made. In other words the correct catalyst had to be chosen wherewith to effect the hydrogenation.

As in most chemical processes when it was attempted to produce an oil from coal by hydrogenation, it was found that other products ensued and interfered with the process. Thus coke was formed instead of oil. On investigation it was discovered that the hydrogenation of coal generated a great deal of heat and this heat was lead off with great difficulty with the result that superheating of the coal substance occurred and instead of hydrogenation, the coal was distilled and coke produced.

It was thus realized that the liquefaction of coal involved two distinct processes. One of these was addition of hydrogen to the coal substance and the other distillation of the coal. It was also found that within certain temperature limits the velocity of the hydrogenation was greater than that of destructive distillation, but as the temperature increased the velocity of the latter reaction became greater. Hence even when a high hydrogen pressure was used and intimate contact of the gas with the coal substance was secured, the product was nevertheless not oil but coke.

The coal starts to hydrogenate at a temperature of 300 to 350 degrees C and the product obtained is still solid. It is in reality a sort of pitch which contains considerable proportions of hydrogen but which has a fairly high melting point. If however the treatment is continued at a temperature of 450 degrees C, then the product becomes liquid. Thus liquefaction consists not only of the addition of hydrogen to the coal substance but also of the splitting of the larger molecules of hydrogenated coal substance into smaller ones while hydrogenation continues. It might be said that the second operation is a cracking process in which hydrogen is absorbed.

The hydrogenation of coal yields a variety of hydrocarbons. The series begins with methane and continues upwards in the paraffin series reaching even the highest molecular weight members. Not only methane hydrocarbons but also aromatic and various aliphatic hydrocarbons are found and also the hydro-aromatic compounds, in fact all sorts of hydrocarbons are present with the exception of course of the unsaturated hydrocarbons which cannot remain unsaturated in an atmosphere of high pressure hydrogen. Furthermore, phenolic substances are present in the oil, chiefly cresol and also ammonia.

It has been mentioned that all sorts of coal can be used as starting points in the manufacture of synthetic petroleum by hydrogenation. However there are certain varieties of coal that are better suited than others, and a great many experiments have been carried out by Bergius and his workers on this subject. Not only coals but lignites were also tested and in fact the investigation included almost every sort of coal known with the exception of anthracite coal. The reactivity of the

(Continued on page 110)

Increasing Output by Reducing Equipment

Operating costs also go down when Torrance company replaces five towers with one stripper

By GEORGE REID
Staff Representative

THE absorption gasoline plant of the Torrance Gasoline and Refining Company, at Torrance, California, is rated in capacity at 7500 gallons and this production derived from a daily throughput of about 7,500,000 cubic feet of gas. The natural gas employed at this plant comes from the Torrance-Redondo oil field, and usually, upon analysis, this gas is capable of producing from one gallon to 1.35 gallons of gasoline per thousand cubic feet, which can not be considered as very rich gas.

Although the plant is rated at the above mentioned capacity in most published lists, it is, at the present time producing a daily average of 9300 gallons of finished gasoline, and from the same volume of natural gas. In other words, through the installation of certain equipment, the company has increased the production of the plant in the last few months, some 2000 gallons daily. This remark may lead one to believe that the company has spent a large sum of money for additional plant equipment effecting an enlargement and expanding of facilities to handle more gas, to make more gasoline. However, this is not the case. What the company has actually done is to reduce their plant equipment and decreased the physical size of the plant—and at the same time increased production and lowered operating costs. Through the installation of one new stripper (evaporator) and one absorption tower of different design, the company has eliminated the use of two old strippers and five old bubble towers, and when, or if, the company removes the five towers and two strippers, and breaks them down for salvage, the revenue from such salvaged material will offset the expense involved in the installation of the new stripper and absorber. This equipment will be described later.

Plant System

The natural gas entering the plant yard is conducted to the compressor house or booster station at about five pounds pressure. In this station the gas is compressed to 45 pounds, which is the working pressure of the absorption plant. The compressor plant consists of four compressor units. The installation is Bruce-MacBeth 165 horse-power gas engines belt driving Ingersol-Rand Imperial type, 16-inch by 16-inch compressors. Four units are handling over seven million cubic feet of gas daily, boosting it from five pounds to 45 pounds pressure. The gas is scrubbed both before and after compression, and cooled in water sprayed coils between the compressor plant and the absorption operation.

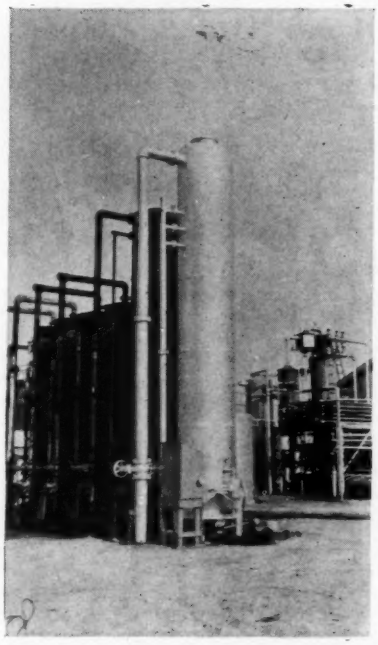


Figure 1—Tower which supplanted the older five absorbers just behind it.

Water for cooling purposes, both for the engines, and the cooling tower as well as the condenser for gasoline vapors is circulated through the system by Terry steam turbines (15 horse-power) driving Cameron 6-inch No. 5 centrifugal pumps. Two such pumps are provided, one of which is idle for emergency needs.

The cooled gas leaving the cooling tower is conducted to the absorber where it is handled in the usual manner, entering at the base of the absorber and exiting at its top, to be conducted then as dry gas to the dry gas scrubber for the possible removal of any oil particles carrying over, which is rare, then to be distributed through a manifold to various lines leading back into the field. A large proportion of this dry gas is returned to the large lease of a neighboring oil company where it is subjected to circulation in several oil wells flowing under gas lift methods.

The oil circulation at this plant is handled by an installation of four Cameron 10 by 7 by 13-inch pumps,—two installed for lean oil and two for rich oil. One of each pair, of course, is auxiliary.

Equipment Removed

The cool lean oil leaving the cooling tower is discharged from the lean oil tank to the top of the absorber. Note in Figure 1—that the absorber to the right hand side of the photograph is provided with an oil line, which at the top of the tower is provided with three lines for distribution of the oil within the tower. The five absorbers in line behind the brightly painted tower in service at the right, were all disconnected and taken out of the system when the new absorber, designed by the firm of Boner and Sheldon, and

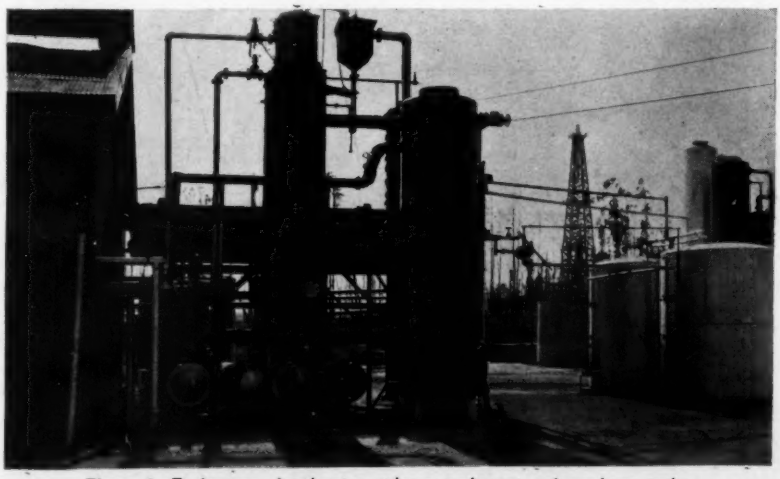


Figure 2—Exchangers, fractionator stripper equipment and rundown tanks.

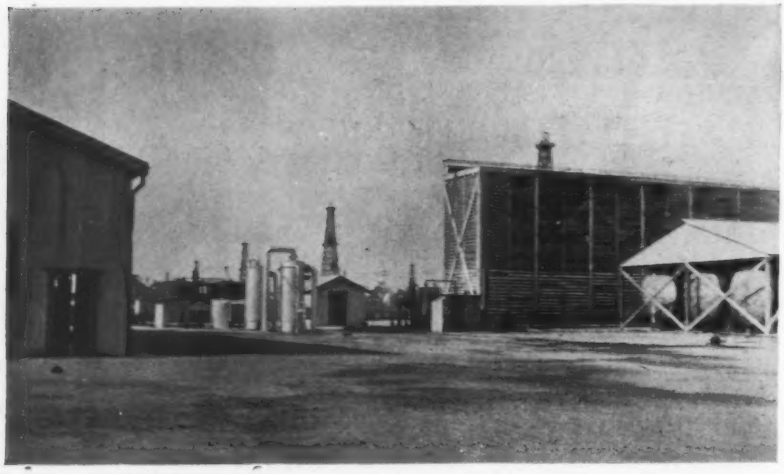


Figure 3—General lay-out of absorption plant equipment.

installed by them, was put into operation. The absorption towers of this type are the usual equipment of the engineering firm mentioned, consisting of an ingenious arrangement of baffles, plates, screen devices, and wires, which are somewhat similar in their arrangement and working principle to the conventional bubble tower. Liquid levels are maintained on each of the numerous trays by means of both cup and downspout overflow devices and especially placed wires, for control of both the level of the liquids as well as its flow through the towers. As previously stated, the lean absorption oil enters the top of the tower or absorber distributed through three diverging lines, as shown in the photograph.

Orifices are provided in these short entrance lines which provide for an equal distribution of the volume of oil entering the three top trays. In this manner the rich gas entering the bottom of the absorber is flowing countercurrent to absorption oil which becomes "leaner" as the gas nears the top or point of exit of the absorber. When this gas reaches the third tray or pan from the top of the tower most of the gasoline content has no doubt been absorbed, but in the third tray from the top the partially denuded gas comes in contact with a much leaner absorption oil. In the second tray from the top this gas meets with a fresh stream of cool absorption oil which has had no previous contact with gas, and in this tray a certain proportion of gasoline is absorbed. In the next tray above this the gas, which is rapidly reaching a state of completed dryness, again meets with an influx of fresh absorption oil which has had no previous exposure to gas. Thus at the top of the tower the gas enters into three zones of fresh absorption oil where the last trace of gasoline is removed.

At the top of the tower, of course, there is provided the usual mechanical features which eliminate the possibility of the absorber oils carrying over. The Boner and Sheldon absorber, as described, is 4 feet by 25 feet in size, handling over seven million cubic feet of gas, and absorbing about 9300 gallons of gasoline daily.

The lean oil is metered into the absorber by a Westcott Orifice Meter using a 24-hour recording chart. The level in the absorber is controlled by a Fisher Kinney regulator. The enriched oil leaving the absorber is conducted to the heat exchangers, four in number, horizontal header type, and from there to the preheater, thence to the Boner and Sheldon stripper, (evaporator). This evaporator uses about 1000 pounds of steam per hour, and all of the steam employed is condensed and returned as water for reuse. Leaving the stripper, the vapors enter a Southwestern fractionator, pass through a Southwestern cooling section (dephlegmator section) and then through Southwestern condensers and to storage. The stripper, fractionator and condenser equipment is shown in Figure 2. The oil from which the gasoline is distilled, is conducted from the bottom of the stripper to exchangers, cooling coils, and returned to the absorbers.

Gas Recovery

Another item of imporvement noted on the plant yard was the installation of a tail gas recovery plant which consisted of an Ingersol-Rand 12 by 10-inch compressor driven by a Westinghouse 50 horsepower electric motor, and which compresses the tail gases and vapors recovered from the storage tanks, run down tanks, etc.

There are some interesting comparative efficiency figures available regarding the operation of this plant, and these efficiencies are based upon the charcoal test. Now, at this time, such a statement—viz. "based on the charcoal test," has but little meaning. The absorption gasoline industry has never perfected an acceptable test and the result of experimental work of many large companies finds the numerous gasoline plant operators following different schools of thought and policy in so far as the gas analysis testing is concerned.

Of the three methods of charcoal testing now in vogue on the West Coast, the Torrance Gasoline and Refining Company employs the following method.—The usual charcoal test procedure is followed at atmospheric pressure and the distillate collected in the usual manner,—however, all of the non-condensible gases are run into a container with a certain volume of mineral seal oil in it, and any gain in volume in this oil is recorded as absorbed gasoline and added to the condensate collected in the first graduate.

Using this method the west field gas averages about 1.32 gallons per thousand cubic feet. Prior to the installation of the new stripper and the new absorption tower (involving the elimination of the five old towers) the plant production was averaging about one gallon per thousand or 7000 to 7500 gallons of gasoline from approximately seven million feet of gas. After the installation of the new equipment the plant production began to show an increase until at present the plant manufactures from 9300 to 9500 gallons of gasoline from the same quantity of natural gas, and the efficiency of the operation based upon the charcoal method of testing prevalent indicates that the usual efficiency is 100 per cent with days on which it is slightly better.

The improvement program recently completed at this absorption plant is of interest, because of the fact that the complete system of operation was changed in its entirety from a system including two strippers (stills) and five absorption towers (bubble type) to the new equipment which embraces only one stripper and one absorption tower, and yet the production showed about 25 per cent increase, operation costs are lowered, and the salvage value of the replaced equipment will more than defray the expense of the new installation.

Elliott Jones Refinery at San Antonio Sold

San Antonio, Texas—The Elliott Jones refinery, located on the Blanco road near San Antonio, was sold January 21 to J. H. Frost, Charles Schreiner, Jr., and S. Seary for a consideration of $150,000. The property included a 64-acre tract on which the refinery was located.

The refinery has been shut down for the past few months, and no announcement of plans has as yet been made by the new owners.

Fire Damages Plant

Fort Worth, Texas.—Damage caused by fire in the Star Refining & Producing Company's skimming and cracking plant in Fort Worth January 5 is being repaired after a loss of $11,000, and operations will be resumed in about 30 days. The plant was running on Panhandle crude, and the fire started near the heat exchangers, and spread to the tail house. H. L. Pemberton is in charge of the plant.

Enlarge Utah Refinery

Salt Lake City, Utah.—Utah Oil Refining Company, a subsidiary of the Midwest Refining Company will add new units to the plant here, increasing capacity from 5000 barrels daily to 9000 barrels daily. The improvements are to cost about $750,000.

Elimination of Plant Losses Subject Of Technical Meeting

Second of plant operators meeting held in Wichita Falls, January 17 and 18

By ROYE C. MUNSELL
Staff Representative

Wichita Falls, Texas.—Elimination of plant losses that occur in refinery operation was the subject of the second plant operators' group meeting held here January 17 and 18 under the sponsorship of the Western Petroleum Refiners Association.

Six prepared papers treating with the subject in several phases were presented. The first topic taken up was the losses due to the wastage of gases and vapors. The ensuing discussion was built around a paper on gas and vapor recovery systems read by B. C. Frichot, Shaffer Refining Company, Cushing, Oklahoma.

Two recovery systems observed by Mr. Frichot were described. With one system gases and vapors were gathered from light oil storage and blending tanks, run-down tanks, casing-head tanks, pressure benzine receivers and receiving houses, and then recovered by compression and absorption, using raw naphtha as an absorbing medium. The rich naphtha is turned over to the refinery proper for further processing. The naphtha product used ranges from 47 to 52 degrees B, with an initial of not less than 250 degrees F and an end point that can be blended off with motor gasoline.

Two Systems Described

In this instance all the large light oil storage tanks and blending tanks are connected into one vapor gathering system. In another system are included the run-down tanks from the various crude batteries, pipe stills, rerun stills and pressure benzine stills.

Each of the storage and run-down tanks are equipped with a flame arrestor, on the top of which is placed a vacuum pressure relief valve. A line goes from each tank to a regulator, thence into the main line to the compressor. Each separate gathering system has its own drip to eliminate water, condensed vapors and foreign matter before the gas enters the main line to the compressor. This line is 12-inches, and has itself another drip.

The compressor used in this case is a steam driven, twin cylinder, 10x16-20x10. The unit is run at 100 R. P. M. and pulls a 10 point vacuum on all the gathering lines connected to it. The gas is compressed to 15 pounds pressure by the compressor and sent into a 12-inch line leading to the coolers.

The pressure benzine receivers attached directly to the cracking unit are held under sufficient pressure so that the vapors from these tanks need not be handled by the compressor.

The gases leaving the compressor as well as those that have been bypassed around it because of their own pressure enter a tower, designated as No. 1, at the bottom. This tower is to cool and wash the gases, and is 4 feet by 20 feet.

Two absorption towers containing raw naphtha are used for absorbing. The gases after leaving cooling and washing tower No. 1 at the top through a 10-inch line enter the bottom of the first absorbing tower. This tower might very well be designated as No. 2. It is four feet by 15 feet and equipped with five trays of bubble caps.

The gas after leaving the top of No. 2 tower is carried by a 10-inch line to the bottom of a third tower, No. 3. This tower is equipped with ten trays of bubble caps. The virgin raw naphtha is first pumped over the top of No. 3 tower. The counter current principle is used. Raw naphtha runs countercurrent to lean gas and enriched naphtha countercurrent to rich gas. The partly enriched naphtha is taken out at the bottom of No. 3 tower and then pumped down through No. 2 tower from the top. From No. 2 tower it goes to the finished naphtha tank.

The lean gas passing No. 3 tower may be recirculated through the system, but it is not found necessary to do so under normal conditions. Instead, it is put directly through a back pressure regulator, operating at 15 pounds on the high side and two pounds on the low side, thence into the fuel system to be burned under stills and boilers.

Value of Recovery

No figures are available as to the amount of gas handled at this plant. The normal gasoline content of vapors, excluding gas from high pressure systems, was found to be from one to one and half gallons per thousand cubic feet. The denuded gas leaving No. 3 tower to the fuel system averages 0.2 gallons per thousand. The minimum yield of the plant since it has been in operation has been as low as 25 barrels per day. The maximum yield has been as high as 114 barrels per day. The daily average for the month of December, 1926, was 72 barrels. These figures are for gasoline. The volume of naphtha used in the system varies from 600 to 800 barrels per day. It was explained that the volume was unimportant other than to have plenty. According to Mr. Frichot, a few of the essential points to watch in the operation of this plant is to keep the drips cleaned out, the regulators from sticking and corroding up, and the compressor clean. The compressor requires a cleanout about once every three weeks. The resultant shutdown is approximately eight hours.

Another recovery system described by Mr. Frichot was in several details similar to this one. One important point of difference between the two systems is that the one at plant No. 2, the system last mentioned, is so arranged that it is in a condition of equilibrium.

At plant No. 2, the tanks are equipped with the usual pressure-vacuum valves from which a breather line, varying in size from four-inches for 10,000 barrel tanks to eight-inches for 55,000 barrel tanks, leads to the a flash screen placed outside of the tank dike at an elevation of four feet from the ground. From each of the tanks leads a separate line to a 10-inch volume header, thence through a regulator, the high side of which operates at one to two ounces and the low side 10 to 15 points vacuum, thence to a 12x12 duplex compressor.

Another system gathers the vapors from the look boxes of the various batteries of stills and run-down tanks. Another compressor, picks up these gases. A regulator similar to the one just described is placed ahead of the compressor.

The casing head gasoline tanks in this instance are carried under sufficient pressure to deliver their vapors through a separate three-inch line direct. The pressure benzine tanks have thier own gathering system and it is so manifolded that this gas can be delivered to the compressor working under the lightest load.

The compressors pull a vacuum from 10 to 15 points and deliver the vapors at a pressure of 25 pounds. The compressed vapors are cooled and a product varying from 85 degrees to 90 degrees B. is trapped out into a receiving tank. The partly denuded vapor is then cycled through an absorption system. In this case regular absorption oil is used instead of raw naphtha.

Two, 20-inch by 60 feet, absorbing towers are used in parallel to further

denude the gas, and an additional third tower to remove all the gasoline possible. The third tower is of the same dimensions and construction as the two parallel towers. The towers are filled with wood grids and the oil is pumped counter current to the flow of the gas.

The rich oil is stripped of its gasoline content in a steam still and returned to the system. The denuded gas leaving the last tower is still under from 20 to 25 pound pressure and is put directly in the gas mains which supply fuel to the stills and boilers. In this case the gases entering the compressors show a gasoline content of 17 gallons per thousand cubic feet. The gases leaving the cooling tower placed between the compressors and the absorbers show a gasoline content of from three-forth to one and one half gallons per thousand cubic feet. A large number of determinations made on the residue gas from the system indicate its gasoline content to be some .075 gallons per 1000 cubic feet. The rich oil going to the steam still shows an absorption of from four to 6 per cent, while the steamed oil shows from nothing to one half per cent.

Fuel and Heating

After the paper and discussion dealing with vapor recovery, the meeting was given over to fuel and heating. Papers on these subjects were presented by B. P. Lientz, of B. P. Lientz & Co., John Thoen, of the Marland Refining Company and W. E. Perdew, of the Derby Oil Company.

The title of Mr. Lientz's paper was "Fuel Economies of Furnaces," and it dealt in a very thorough fashion with the combustion of liquid fuels, furnace construction and the proper and effective application of heat as relates definitely to the furnace. The paper is carried in full elsewhere in this issue.

"Fuel Economies at Refineries" was the title of John Thoen's paper. This paper described in detail many fuel economies worked out at the Marland Refining Company plant at Ponca City, Okla. This paper is also carried in full in this issue.

Mr. Perdew's paper, "The Burning of Heavy Residual Oil at Refineries," not only had a bearing upon the problem of fuel economy but also upon the problem of what to do with the residues from cracking stills. This is an acute question with not a few refiners. In Mr. Perdew's paper was described the method worked out by the Derby Oil Company to burn the residium for fuel at the refinery. Instead of running to a coke, processing is stopped at a point which just leaves the residium in a liquid state. This heavy liquid is used for all fuel purposes. Both a fuel problem and a disposal problem is solved with the method they are employing. "The Burning of Heavy Residual Oils at Refineries" will be found elsewhere in this issue. Pictures illustrating the article accompany it.

Reclamation of Fuller's Earth

Probably the least recognized waste in refinery processing is that which occurs in the revivification of Fuller's earth used in filtering. What might be done in the way of cutting down losses in reconditioning earth was presented to the assembled operators by a paper on "The Revivification of Fuller's Earth", prepared by H. W. Camp, of the Empire Refinieries, Inc.

The new Wedge type burners installed by the Empire Company at its Ponca City and Okmulgee plants were described. With this type of burner it has been found that the efficiency of the earth is in no way impaired by the number of burnings. This has materially aided in reducing the amount of bin storage necessary. The only separation that needs to be made is between new or unburned earth, dirty earth and burned earth.

With the Wedge type of kiln, stack losses, losses from overheating and handling losses have been very materially reduced by the Empire Company.

A description of the Wedge type kiln installation at the Okmulgee plant of the Empire Refineries, Inc. was carried in the September, 1926, issue of the REFINER AND NATURAL GASOLINE MANUFACTURER. Pictures and drawings show the method of construction and operations.

Bubble Towers

At the banquet held during the evening of the first day of the sessions, F. C. Koch, of Winkler & Koch, consulting and construction engineers, Wichita, Kansas, presented a paper on the construction and operation of bubble towers. Bubble towers are still a comparatively new type of fractionating equipment and Mr. Koch's paper and the drawings he used to illustrate

U. S. Bureau Analysis Shows Panhandle Crude Similar to Lima-Indiana District

Washington.—Crude oil produced in the Panhandle field of Texas has gained the reputation of being a difficult crude to refine. This is largely due to the fact that the oil contains sulphur compounds which are difficult to remove from the gasoline and other products. The crude as produced usually contains a small amount of emulsified water, which should be completely removed in the field as it is corrosive to refinery equipment, and the high wax content of the oil causes it to congeal in storage tanks and pipe lines and makes it difficult to transport during cold weather. The Bureau of Mines, Department of Commerce, has accordingly made a brief investigation of the nature of this crude, and has published analyses of typical samples in Information Circular 6014, by N. A. C. Smith, superintendent of the Petroleum Experiment Station at Bartlesville, Oklahoma.

Two samples of those analyzed by the Bureau of Mines represent oil from the "granite wash" or arkose deposits, while two are from the "lime" formation of the Panhandle field. A comparison of these samples indicates that the oil from the granite wash should be somewhat better than the oil from the lime, as the pour points and cloud tests indicate a slightly lower wax content and the sulphur content is also slightly lower. Furthermore it is known that the natural gas associated with the oil from the granite wash contains less hydrogen sulphide than the gas associated with the oil in the lime formations, and this would indicate the probability of a lower content of objectionable compounds in the oil itself.

The differences between the oils are slight, however, and all four samples show a percentage of sulphur (average 0.60 per cent) that is high for oil of this character. The gravities of the distillation fractions indicate clearly that all four of these samples are paraffin base crudes, and it is decidedly unusual to find paraffin base oils with sulphur contents as great as 0.50 per cent. An inspection of these analyses indicates a similarity to the oil found in the Lima district of Ohio and Indiana, sometimes called the "Lima-Indiana district."

The results of analyses of two typical samples of crude oils from the Lima, Ohio, field are also given in Information Circular 6014. The similarity between these and the samples from the Panhandle is striking. Very little Lima crude is benig refined today as the fields are almost exhausted, but when they were at the height of their production special refining methods were worked out and adopted in order to make satisfactory products, and it would seem that present day refiners might study these methods to advantage in the handling of Panhandle crude.

The geology of the Panhandle field is somewhat obscure, but enough is known of it to indicate that this crude is certainly very old, in the geologic sense. This is also true of the Lima oil, which is found in one of the oldest of the producing formations.

The importance of the problems involved in handling this type of oil is shown not only by the size of the Panhandle field, but by the fact that other oils in the western part of Texas are similar in character. Results of analyses of the samples of two typical oisl from the Big Lake field, about 300 miles south of the Panhandle, are also given in the circular.

Construction and Operation of Bubble Cap Towers

Paper presented before the technical executives of Western Petroleum Refiners Association, Wichita Falls, January 17-18

By FRED C. KOCH
(of Winkler and Koch)

WITH the exception of cracking, probably no other refinery operation has so much bearing on refinery costs and profits as efficient distillation. The refining industry has been somewhat slow in recognition of this fact and in profiting by the principles of distillation and fractionation which have long been known in other industries. However, economic pressure within the last five years has provided the necessary stimulus and the industry has made rapid strides in the development of distillation apparatus for securing maximum yields of the more valuable products from any stock with a minimum of redistillations and with a decreased expenditure of fuel.

The types of fractionating columns, both good and bad, which have been tried and used in the refining industry in the past have been numerous and varied. Within the past five years it has been proven by hard experience that no other type of column or tower as yet developed has the all around efficiency under the wide range of conditions encountered as the bubble tower.

Originally developed in the alcohol industry in France a great many years ago, the bubble tower and modifications of it have found wide usage in practically all the industries using distillation processes. An examination of the works of some of the French and German savants reveals that the types of bubble towers which have been tried are legion and are limited only by the imaginations of the men who designed them.

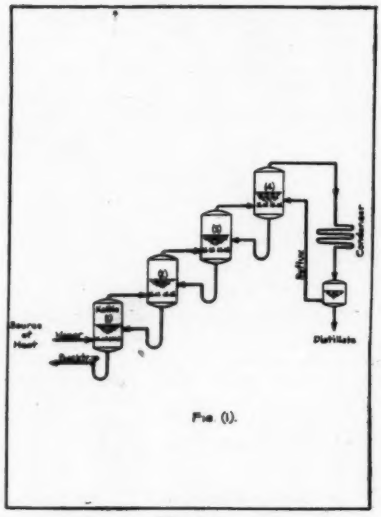


Figure 1

Simple Example

The simplest concept of a bubble tower can be arrived at by visualizing a series of kettles as shown in Fig. 1.

If oil vapor from some outside source is introduced beneath the liquid in kettle (1) it will be higher in temperature than the liquid and will contain more heavy constituents. By allowing this vapor to bubble through the liquid it will be cooled considerably and will have a large portion of its heavier constituents condensed to remain in the kettle. The vapor leaving the kettle will be lighter than that entering. If the vapor flows in this manner through the series of kettles it will be seen that it will get progressively lighter and lighter.

In order to supply the liquid or reflux for the last kettle a portion of the final condensate can be returned to kettle (4). It is obvious that for a given amount of reflux the more kettles in series the sharper will be the separation between the final condensate and the liquid leaving the first kettle.

It is but a step from a system of this character to a tower as shown in Fig. 2.

The vapor traveling up through this column becomes progressively lighter and lighter and the liquid traveling down the column becomes heavier and heavier. It is obvious that a perfect column of this character would be one in which the vapor above each deck was in equilibrium with the liquid on that deck. The nearness to which this condition is approached is a measure of the efficiency of each deck.

In any given problem of fractionation the greater the number of decks which are used the less will be the amount of reflux which will have to be returned to the column and consequently the less the fuel consumption. However, even when the number of decks used is infinite there is a certain minimum reflux ratio below which it is not possible to go.

It is rather doubtful if accurate data on this particular feature is in existence in the petroleum industry so that the number of plates is left to the judgment of the designer, or more often is limited by the amount of money which the refiner cares to spend.

The Best Tower

On the other hand, if the decks can be made more efficient a fewer number can be made to do the same work or the same number will require less reflux for any given job of separation.

The best tower for the refining industry is the one which will give the desired separation with the least fuel consumption, which is easiest to operate and control, which will resist corrosion longer, is less likely to become stopped up, and which is easiest to disassemble and clean.

The first essential feature of a bubble deck is that intimate contact can be secured between vapor and liquid. This is brought about to a large degree by the

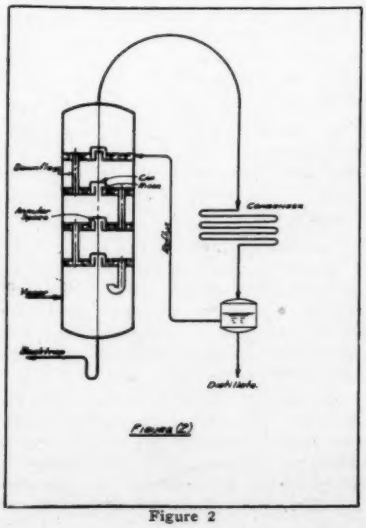


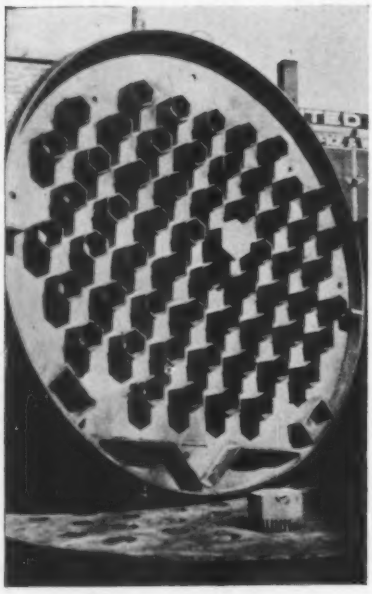
Figure 2

---

it took out a great deal of the "mystery" of their construction and operation. Mr. Koch's illustrated paper, "The Construction and Operation of Bubble Cap Towers", is presented in full in this issue.

During the afternoon of the first day of the meeting, the visiting attendants were taken for a trip of inspection to the plants of the American Refining Company, the Panhandle Refining Company and the Continental Oil Company, all located near Wichita Falls. Roy B. Jones, first vice-president of the Western Petroleum Refiners Association and president of the Panhandle Refining Company of Wichita Falls, had charge of the meeting. Dr. C. K. Francis conducted the several group sessions.

This meeting was the second of a group to be held. The first took place last fall at Ponca City, Oklahoma. These meeting will take the place of the technical programs of the annual conventions of the association as they have been held in the past.



Six-foot Bubble Deck Cast in One Piece

serrations or slots in the bubble caps since they split the vapor into comparatively fine streams.

There has been a considerable discrepancy in various bubble cap designs especially as regards the size of slots used. Some have even gone so far as to saw extremely fine slots in the caps with the result that the slot openings were so restricted that a large and dangerous back pressure was developed. Generally speaking, it is very bad practice to use fine slots in petroleum fractionation since corrosion and foreign material will soon plug them up.

Improper Distribution

When a tower is in operation there is a froth extending several inches above the top of the caps and it is probably there that most of the intimate contact occurs.

The downflows or weirs which conduct the liquid from one deck to the next should be of very liberal capacity and they should be so arranged that practically perfect distribution of liquid over the caps is obtained. One fault with most bubble tower designs is this imperfect distribution.

The downflows themselves should have large cross sections not only to carry away the volume of liquid necessary but to permit of passage of any ordinary foreign material.

It is not advisable to make the liquid follow a long and tortuous path since the height of liquid at one point will be higher than at another. This will cause most of the vapor to go through those caps which have the lowest height of liquid above their slots.

The proper height of liquid to maintain above the slots is determined by several factors, notably the back pressure which can be permitted, the amount of reflux which is traveling over the deck and the vapor velocity which it is intended to use. The capacity of a given diameter of tower varies to a certain degree with the height of liquid which is maintained above the slots. The pressure drop on most tower designs varies from one inch to three inches of water per deck.

It should be remembered that when crude or other stock is charged in a bubble tower it materially raises the liquid level on those decks beneath the charge point.

The distance between decks is a very important features as the entrainment from deck to deck becomes considerable and the capacity is materially reduced when the decks are too close together.

The caps should not sit directly on the plate since any rust or other foreign material is immediately caught in the slots. It is better if they are about one-half an inch away from the plate since this will allow most of the foreign material to wash by and will also give an opening of escape for any excessive vapor loads which the tower is called on to handle, which may be from a "shot" of water or other cause.

Back Pressure

There are certain limits to the proportions of riser area, annular area, and slot area which make for smoothest operation with least back pressure. Some bubble tower designs use a very high velocity through the slots but this is always at the expense of added back pressure.

The back pressure on a column depends on the mean static head of liquid above the slots on each deck, and the velocity of the vapors through the risers, annular spaces, and slots. The back pressure increases very rapidly with increase in vapor velocity through the column.

Some designs of towers call for a well around the bottom of the downflows on each deck, on the theory that if any vapor should escape up this downflow it would prevent the liquid from descending. It has been the writer's experience that these wells are easily plugged up and apparently do not serve the purpose.

If some packing material, such as Raschig rings, is placed above the decks on a column it will serve to break up the froth and bring the interior of the bubbles into contact with the liquid, thereby materially increasing the deck efficiency. Most any device which will reduce the entrainment from one deck to the next will increase the deck efficiency.

The capacities of bubble towers offer a rather interesting field for study. As stated previously, the capacity of a column for vapor is dependent on the distance between decks, the submergence of the caps, the density of the vapor, and on all those factors which influence entrainment such as the surface tension of the liquid, the difference in densities of the liquid and vapor, etc.

It is not possible to use the calculated vapor volumes as the sole criterion for the capacity of a column as is so often done. In the first place, the calculated volumes are very much in error, due to the extreme divergence of condensing vapors from the Gas Laws. An examination of the operating data from some 25 columns working under very extreme conditions as regards both temperature and pressure such as natural gasoline absorbers, on all steam stills, crude stills, rerun stills, pipe stills, and pressure stills shows a range of operating velocities figured on the cross section of the tower of from 0.13 to 4.0 feet per second.

Serious Defect

The most serious defect a bubble tower can have is to be too small both in diameter and height. Usually the slower the rate at which a tower is operated the closer will be the separation due largely to the lessened entrainment, the increased ease of operation, and to an unconscious increase in the reflux ratio on the part of the operator.

The refiner is only interested in the theoretical considerations involved in bub-

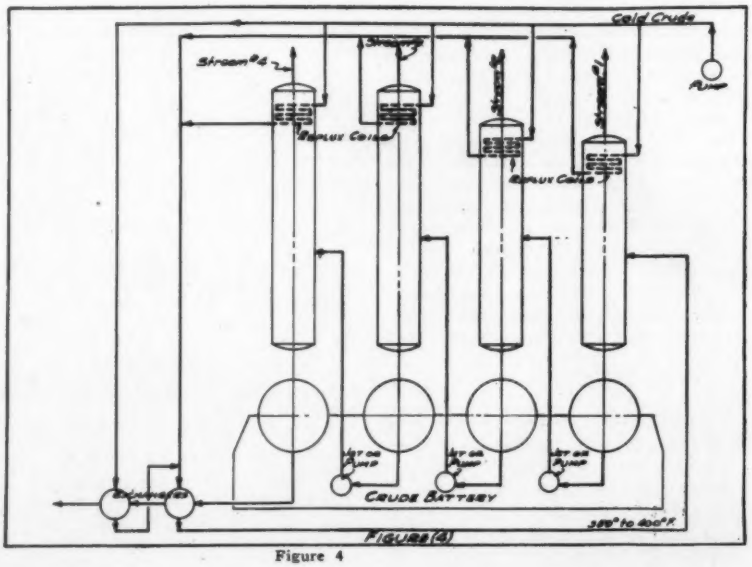


Figure 4

ble tower design as a means to an end. He desired a tower which first of all will give him clean cup separation, with small fuel consumption, the initial cost of which must not be too great. It must be arranged so it can be controlled by a none too skillful operator, and must be of such materials of construction that its life will be long. Also a most vital consideration is that it must remain in operation without repairs for 350 days out of every years.

Corrosive Conditions

The corrosive conditions encountered in a bubble tower are very often rather acute, due principally to salt and sulphur in the crude.

The use of steam or the water present in the crude hydrolyzes the magnesium chloride to hydrochloric acid and corrosion begins wherever condensation takes place. It is sometimes wondered why the decks in a bubble tower should corrode so much worse than the tower shell. This is due to the repeated condensations and vaporizations which take place on the decks.

The reflux coils in the top of a tower are usually the first to corrode and the top decks are next. The bottom decks in a tower very seldom corrode badly. The only inexpensive material which will withstand this corrosion for long periods is cast iron, and it is a mistake, the refiner soon pays for, if he makes his decks of anything else. A deck made of sheet steel with nipples welded in it will corrode out very quickly.

The reflux coils should also be made of cast iron where corrosion is to be expected. They should be of such a type that they are easy to replace or renew, and occupy little space.

At any point where oil is charged in a bubble tower plugging of the trays will result in from three to eighteen months. This is true regardless of the type of oil charged. Sometimes it is due only to invisible solid matter in the oil and sometimes to a slight cracking. Very hard coke deposits occur in places in the tower where it would not seem possible for any cracking to occur.

This requires that manways be provided above those decks where plugging is most likely to occur. However, if the coking has been bad it is almost impossible to clean the decks through a manway and the tower had better be disassembled.

For ease of construction and ease of taking down, and to facilitate cleaning, the decks should be designed as simply as possible. It is not good practice to try to design a highly efficient deck at the expense of making it so complicated that it will soon plug up and when plugged will be very difficult to clean.

Fractionating equipment has been developed to such perfection that it is possible to secure maximum yields of any particular product from any stock without rerunning.

This is illustrated by the following streams from an ordinary shell still crude

VIEW SHOWING GENERAL ARRANGEMENT OF BUBBLE TRAYS

battery arranged as shown in Figure 4.

Stream No.	1	2	3	4
Gravity	65.0	56.0	44.0	38.2
I.B.P.	100°F	326°F	388°F	440°F
10%	164	350	404	462
20	200	352	406	468
30	240	356	408	472
40	261	360	410	476
50	276	362	412	480
60	290	364	414	484
70	301	367	416	488
80	312	372	418	495
90	320	376	424	501
EP	324	385	434	518

These separations are being obtained with about 20 per cent less fuel than was formerly used.

Gapping

By blending these various streams it is possible to make a maximum yield of products which have a maximum value at any particular time. For instance the kerosene cut can be entirely eliminated or a maximum yield of it can be made at will. Similarly a maximum U. S. Motor gasoline can be made or it can be entirely eliminated and nothing but 375 E. P. gasoline and kerosene produced. This operation has far greater potentialities for increased profits than is generally realized.

The most exacting test of a tower is this "gapping" of successive streams, i.e., having the I. B. P. of one stream higher than the end point of the preceding stream. It is relatively easy to "gap" the overhead from the bottoms, but more difficult to "gap" succeeding close cut streams.

This "gapping" is a paradoxical phenomenon inasmuch as it really does not exist, but is only indicated due to the inefficiency of the Engler flask as a fractionating column. If the distillations were taken on a small bubble tower the "gaps" would not show up. However, they form a quick and positive criterion of the efficiency of a tower and are very useful.

The color of the various products from a bubble tower, including kerosene, is very much superior to that from any other tower. It is highly desirable to be able to regulate the percentage boiling below 437 degrees F. in the kerosene fraction, but still more necessary to be able to produce a 500 degrees F. EP kerosene with a 510 degrees F. I. B. P. gas oil.

Leaving kerosene fractions in the gas oil fraction is a more common and costly failing than that of leaving gasoline fractions in the kerosene.

From pressure distillate the refiner should be able to produce a 430 degrees F. EP gasoline with a 450 degrees F. I. B. on the bottoms as shown in these results:

Treated Pressure Distillate	Pressure gasoline bottoms	P. D. Engler Distillations
Gravity	49.6° Be'	54.8	34.4
I. B. P.	140°F	120°F	450°F
10	190	191	474
20	243	233	486
30	287	265	496
40	330	290	505
50	376	313	514
60	420	337	523
70	460	362	538
80	498	384	556
90	548	406	558
EP	596	431	612

Per cent yield—68.0.

Since most of the intermediate points are above those of U. S. Motor gasoline, the end point of the gasoline will have to be reduced to 400 degrees F. to meet the other points in the specifications. This accounts to a large degree for the amount of 400 EP gasoline which is beginning to be found on the market at U. S. motor prices.

On pressure distillate an efficient bubble tower should produce 2.0 per cent more of the same end point gasoline than the Hempel column. Most refiners take the per cent indicated at 410 degrees F. on the Engler curve as being the percentage of 437 EP gasoline that can be obtained from an ordinary tower. An efficient bubble tower will obtain from 2.5-8.00 per cent more of 437 EP gasoline than that indicated on the Engler curve *not at* 410 *degrees F., but* 437 *degrees F.*

It is a comparatively easy matter to produce even very close cut fractions of special boiling range, such as painter's napthas or special solvents on either shell stills or pipe stills.

On pressure stills, where bubble towers are used to produce end point gasoline, it is found that the larger the tower and the greater the number of decks that are used the better colored will be the gasoline. This is undoubtedly due to the polymerization of the color bearing bodies brought about by the constant boiling on the decks. An increase in operating pressure on such a tower will also improve the color, since the temperatures on the decks are increased as well as the time element. The writer is of the opinion that if a large enough bubble tower is used a gasoline of plus 25 Saybolt can be produced directly from any cracking process using heat and pressure.

Figure 1—Flash stills installed by the Derby Oil Company for utilizing Dubbs still residuum as fuel.

Figure 2—The condenser forms the roof for the pump house.

Burning Heavy Residual Fuels At Refineries

Paper presented before technical executives of Western Petroleum Refiners Association, Wichita Falls, January 17-18

By W. E. PERDEW,
Derby Oil Company

THIS is an account of the experiences that we have had in burning heavy Dubbs still residues at our refinery at Wichita, Kansas. Cracking processes other than the Dubbs may perhaps yield heavy residues which are ordinarily difficult to burn, or which present a problem of disposal. What will be said here in regards to Dubbs residues can probably be applied in general to residues from other cracking processes and also to the residues from tube stills taking off large overhead percentages.

If the Dubbs process is run for the maximum gasoline yield, it must be either operated on a non-residuum basis or to a very heavy residue entirely unsuited for a fuel under ordinary conditions and temperatures.

In the event that reaction chambers are small and topped crude is being used in the pressure stills, the non-residuum run is not likely to be profitable because of the percentage of down time incurred. With our equipment it appeared inadvisable to attempt non-residuum operation.

It is possible to produce from the average topped crude a heavy residue that is a fairly good commercial fuel under ordinary conditions, but in so doing less than 50 per cent pressure distillate can be taken care of.

It is our opinion that any cracking process should be run for the maximum gasoline yield, and the use and disposal of by-products should be worked out to this end as much as it is feasible and practical to do so.

Instead of taking off only about 50 per cent pressure distillate and having as a by-product a commercial fuel on our hands, we run to 75 per cent pressure distillate and utilize the residuum as a plant fuel by special handling.

It is our policy to take off as high a percentage of pressure distillate as is possible and still have a fluid residue. By tank guages this pressure distillate runs around 75 per cent and by meter readings from 80 to 82 per cent. If we should take off a higher percentage our residuum draw off lines would have a tendency to plug up.

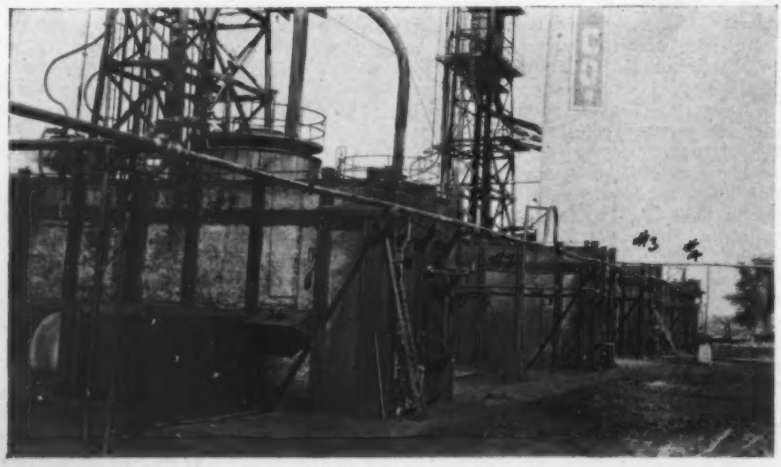


Figure 3—The four Dubbs units showing the circulating line running along the front.

Flash Stills

Instead of drawing this heavy residuum through cooling coils in the usual manner, we permit the pressure of the reaction chambers to blow it directly into a residuum flash still. When we bring a unit down we blow all the heavy material into this flash still as well. Figure No. 1 shows a pair of these flash stills that we have installed.

We have two stills, one acting as a standby. The stills are cylinderical, butt welded chambers 10 feet, 8 inches in diam. 16 feet, 5 inches high, with a dome one foot, 11 inches and a conical bottom 3 feet, 2 inches deep. They stand vertically on steel supports, which elevate them so that the cone is about 6 feet above the foundation. There is an 18-inch manhole in the bottom of the cone and a 24-inch manhole in the top of the still.

The residuum line leading from the Dubbs chambers to the flash stills is two inches, extra heavy, with all-steel fittings. This line is well insulated and equipped with adequate expansion bends.

Steam is admitted in the flash still through a circular perforated pipe placed near the bottom. A distillate is taken off overhead through a six-inch vapor

line. The condenser box stands on top of the pump house and forms the roof. See Figure No. 2. In this condenser box is placed about 900 square feet of Sterling sections.

The average operating temperature of the flash still is 500 degrees. It sometimes gets as high as 600 degrees and has been as low as 350 degrees. When the temperature gets below 400 degrees, however, the substance becomes too cool for easy handling. To maintain the temperature in the flash still, it is heavily insulated. For this purpose slabs of two-inch Banrock are used with a covering of asbestos cement hardened with Portland cement. Over all is placed a plastic asphalt coating.

In brief, the method handling the hot residuum in the flash still as a fuel is to circulate it through a trunk line which encircles all the Dubbs units. Figure No. 3 shows this line running along the front of all four Dubbs units. Figure No. 4 shows the hook up at the No. 3 Dubbs unit.

In the one and one-half-inch circulating line running in front of each furnace, we have a one and one-half-inch by one-half inch prop forged steel tee. Into this is screwed a short nipple followed by a No. 7 Crane globe valve equipped with a composition seat for handling hot oil. The globe valve is followed by a short nipple and then a tee for the steam connection, and then comes the burner. The reason for providing this steam connection is so that the entire one-half-inch line leading to the burner can be thoroughly steamed out just the minute the burner is turned off.

Prevent Cooling in Line

It might be well to mention here that wherever any part of any line handling the residuum may be shut off or shut down we have placed a steam or a gas oil connection. It is absolutely essential that whenever the movement of the hot fluid in the line is stopped, the residuum must be removed completely with either steam, or charging stock or gas oil before it has a chance to cool off. If this circulating residuum becomes cold in any line, even though it does not entirely plug the line, it cannot be removed by recirculation of the hot residuum. Once a deposit is formed, we have found that it is there until it is removed with Lagonda cleaners or some such mechanical device.

Figure 6—Residuum and circulating lines at the rear of Dubbs unit No. 3. The upper line is the circulating and the lower the residuum line. Note the method of hanging the lines and the hangers insulated against fire.

In burning the residuum we use the No. 1, or smallest size, Airoil burner. We have had no apparent difficulty with small particles clogging up the burners and burner valves. If, however, the hot residuum moves too slowly it will cool down and have a tendency to choke. Because of this, we are firing from but one of the furnaces. Burners, however, are placed at both ends. If the burner at one end plugs up, we light the burner at the other end and remove the plugged burner for cleaning.

For circulating the hot residuum we use two Worthington 10 x 4 x 10 Duplex steam pot style valve pumps. These pumps are designed to handle material with a temperature up to 625 degrees F.

The suction line is three inches and in it are used extra heavy malleable and some steel fittings. In each line near the still is placed a still thermometer for checking the temperature of the residuum. This suction line connection is made to the stills two inches above the cone bottom.

Besides two pumps, we have two suction lines and two suction manifolds. There is but one discharge line as well as one circulating line. It is essential to have two independent suction manifolds since they give us much trouble, because of their tendency to choke up. The connections on the suction lines and manifolds are such that they can be easily opened up for cleaning with air tools and blown out with both steam and gas oil from a high pressure pump.

A uniform pressure is maintained in the circulating line with a Fisher governor on the pump and also by pinching down on the valve in the line just before the residuum returns to the still.

Large Air Chamber

It was found necessary to put a rather large air chamber between the discharge line and the pump governor. This chamber is made of a piece of six-inch pipe and is partially filled with either gas oil or charging stock. The connection between the chamber and the pump discharge line has a tendency to plug up with cold residuum and should be so designed that it can be shut off right at the discharge line and steamed and cleaned out easily.

We do not know just how much of this residue that we are circulating, probably four or five times as much as we are burning. When we put this system into operation we would get from time to time a surplus of residuum and have to pump it into a pond that we had been using to hold all of our residuum, using the circulating pump for this purpose.

Lately, however, we have become more proficient in the use of the equipment and our pumpings to the pond are less frequent.

The amount of residuum available in the flash stills is controlled by the steam introduced. The more steam that is introduced, the more gas oil you distill off and the less residue there is left to burn. The amount of pressure distillate taken

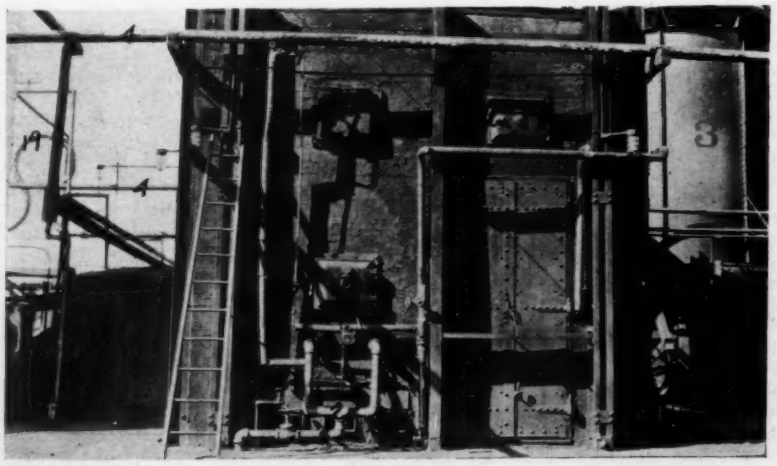


Figure No. 4—The front of Dubbs unit No. 3. Line designated as 4 is the circulating line. Note the return line running behind the unit. Pipe 19 is the draw-off line and 7 is the steam line. 24 shows arrangement of gas burners kept in place for emergencies.

off overhead on the Dubbs units is also a factor, and there must necessarily be close co-operation between the Dubbs still operators and the men operating the flash still.

We bring one of our four Dubbs units down at 4 o'clock each morning, and the flash still operators must so regulate their operations that the flash still is almost empty at this time. This is necessary in order to take care of the large quantity of residuum from the Dubbs still. If, by chance, the fuel level in the flash still should get too low, one of the Dubbs units must be cut out into it for a little while to keep it from going on air.

Cleaning Flash Stills

Each flash still must be cleaned about every eight to ten days, with our type of operation. If we were running a cleaner charging stock this period might be as long as 15 days or more. However, there is a slow accumulation of solid or semi-solid material in the cone of the flash still which, after a time, finally reaches the suction line. When it does suction is lost and cannot be regained. We try to switch from one still to another just before this occurs, and our present cycle happens to be about eight days.

The switching from one flash still to another is very easy. We simply turn the steam into the second a few hours before we are ready to use it and then cut the Dubbs residue into the second instead of the first.

What residue that might happen to remain in the first still is pumped into the second still. This is accomplished by simply cutting the circulating line into the second still and running until No. 1 is empty. When No. 1 is empty, it is cut out.

After being cut out, steam is blown through the bottom of the cone for about 12 to 18 hours, thus distilling out all of the gas oil possible. When this operation has been carried to completion the vapor line is cut off and steam introduced through the regular opening. By manipulating the steam above and below the cone, it is possible to blow out all the hot fluid remaining in the still into a little pond. This pond is lined with coke dust, it might be mentioned.

In the manner we get from four to six barrels of an asphaltic-like substance that is sometimes liquid and sometimes solid at ordinary temperatures. The quantity of this substance is so small that it presents no disposal problem. We have been putting it on our roads and find it works very well in surfacing.

After we have blown out all the hot oil or fluid asphalt that we can, cold water is turned into the still until it is cool. The material remaining in the still is very hard to cool and a day or two is required to reduce its temperature so that a man can enter.

When the still is cool, we take off the top and bottom manholes and a man goes in with a bar to clean out. In a very short time he is able to bar all the material out. This material is very brittle when cold and there is no difficulty in removing it. We get about 10 to 15 tons every cleanout, which makes only about one ton for every 1000 barrels of charging stock.

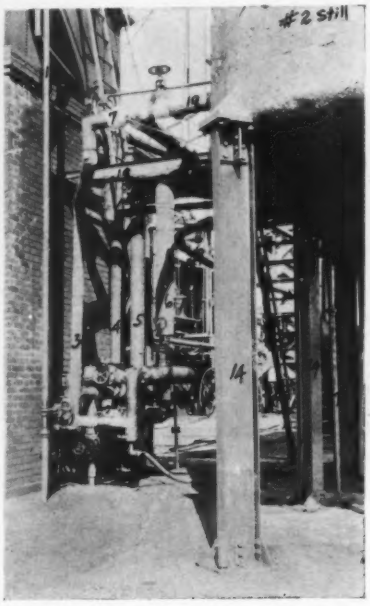


Figure 5—Suction and discharge manifolds. The steam line connecting to all manifolds is shown as 3; the circulating line is 4; the suction line from still is 5, and the suction line from still No. 2 is 6.

This material pulverizes very satisfactorily and we have no difficulty in disposing of it along with the Dubbs still "fines" to a nearby cement plant.

Cost of Installation

The total cost of our complete plant for handling these residual oils in this manner is in the neighborhood of $14,000. The stills cost $1300 a piece and pumps $765 each. Steel valves and fittings, pipe, foundations and other materials, and labor make up the remainder.

We have operated this equipment continuously 100 per cent of the time since July 5, 1925. Since then we have used no other fuel in our Dubbs units, excepting some natural and Dubbs gas in July of that year when we had only one flash still in. During August we set the second flash chamber and since then have used no other fuel whatever.

It has been our experience that this hot residual oil makes a better fire and provides a more uniform furnace temperature than will Dubbs gas and natural gas mixed.

During October we were required to remove our residuum lines because they were clogged, despite the occasionally steaming that they had received. After getting underway again we have not only burned any other sort of fuel, but we have also not made any Dubbs residue that has not been burned.

Operating labor consists of one man at 50 cents per hour, 24 hours a day (three shifts). This operator also repairs, cleans and services all burners. Repairs, and maintenance, it ought to be mentioned, have been very small. Cleanouts cost about $10.00 each.

The operation of this equipment depends upon the following properties of this class of residues:

1. At higher temperatures—350 degrees and above, the hotter the better, there are no solid particles to speak of in the residuum. What solid particles there are in the substance are apparently partly in suspension and partly in a colloidal state.

2. The "gas-oil" that is flashed off acts as a precipitant for these tarry particles, and the residue is far more homogeneous and more thoroughly fluid without the gas oil than with it.

In this connection it might be well to say something about the gas oil secured. The yield is variable depending upon Dubbs still operation and the character of the charging stock. We are getting about five to seven per cent yield with our charging stock.

An Engler essay on a sample of this material shows:

Gravity	26.2°
Initial	250°
20%	506°
50%	568°
90%	666°
Dry	738°

We have been rerunning this material in a batch still, cutting the first part of the stream into pressure distillate, the next part into stove distillate, and the remainder into the charging stock.

It might be possible to design and operate a tower on the flash still to handle this product, which would eliminate rerunning. The output of our flash still is rather erratic and the operation of the tower from it may not be very successful. We have never tried it.

Tagliabue Catalog is Much Enlarged

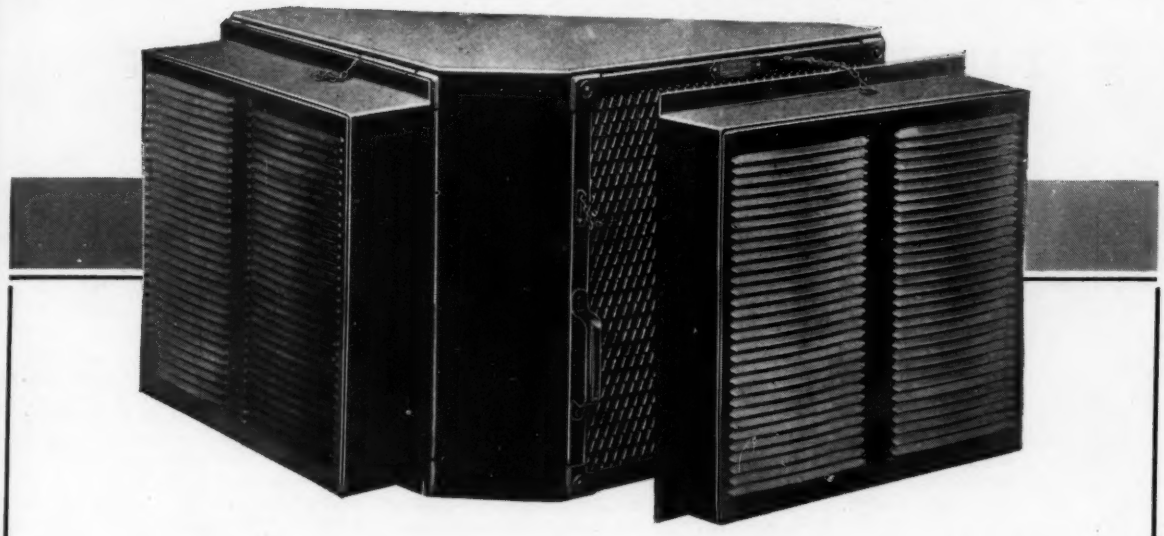
The C. J. Tagliabue Manufacturing Company, 18 to 88 33rd Street, Brooklyn, New York, announces its newly revised and greatly expanded catalog, No. 905-C.

In its 104 pages on which there are 320 illustrations, the catalog covers the many recording instruments made by the company, including Tag Mercury, Vapor Tension and Gas-filled Recording Thermometers, Dial - Indicating Thermometers, Recording Hygrometers and Psychrometers, Time Operation Recorders, Vacuum and Pressure Recorders, Tag Recording Controllers, etc.

The new sixteen page introduction is a feature of the catalog. It starts off logically with an aptly illustrated story entitled, "What WAS the Temperature?" showing the broad reasons for the use of recording instruments. On page two is a striking effect with the title "What a Chart Can Tell You," and the article does explain this in a dramatic way.

Every instrument made by the Tagliabue Company is completely illustrated with several cuts, some of them full page size.

Copies of the catalog will be mailed on request to the company.



The mustache is considered a useful adornment in the British Army as an aid to endurance. This primitive air filter catches the dust particles rising in a cloud from the marching feet.

Reed Air Filters Mean Plant Endurance

Plant endurance means money saved. Why not eliminate the cost of reduced efficiency by dust-clogged compressors and engines. Clean air is as indispensable to the vitals of an engine or a compressor as it is to the vitals of a soldier.

Reed Filtered Air is Clean Air—air free from all dust, grit and other foreign matter that is usually sucked in. Tests have proven conclusively the economic value of Reed Air Filters by leading refiners.

Put one on your engine or compressor. Run it thirty days and then clean the filter. You will be amazed at the quantity of dirt which has been prevented from entering the working parts.

Ask for our new catalogue of Reed Air Filters.

REED AIR FILTER CO., INC.

Louisville, Kentucky

Distributed to the Oil Industry by

SMITH SEPARATOR COMPANY

Tulsa *Okla.*

TEXAS OFFICES:
924 Post-Dispatch Bldg.,
Houston, Texas

1414 F. & M. Bank Bldg.,
Fort Worth, Texas

CALIFORNIA OFFICE:
2039 East 38th St.,
Los Angeles, Cailf.

LOUISIANA ADDRESS:
240 Dalzell St.,
Shreveport, La.

Mention Where You Saw the Advertisement

Furnace Design Large Factor In Fuel Economy

Discussion of fuel efficiency before technical meeting at Wichita Falls, January 17 and 18

By B. P. LIENTZ
B. P. Lientz and Company

EVERY furnace and combustion chamber should be especially designed to meet specific conditions. The acceleration of combustion by heat is a chemically well known fact, and a most important factor in the burning of Hydro-Carbon gases. The gases of low ignition temperature, such as Methane, Ethane, and Ethylene, burn as flames of inferior luminosity, and even Acetylene, that also has a low ignition point, produces the characteristic flame of brilliant luminosity only after having reached its disassociation temperature, which temperature lies beyond the disassociation of the first named Hydro-Carbons.

Therefore, rapid rising of the gases to a high disassociation temperature is chemically required in order to avoid the premature burning of Acetylene gases before disassociation takes place and in order to avoid the forming of gases of incomplete reaction.

The three essentials for combustion are —*sufficient air supply, intimate contact between air and fuel, and a high temperature kept up to the ignition point and continued until combustion is complete.* Either insufficient air supply or insufficient contact or too rapid cooling are the usual causes for incomplete combustion or incomplete reaction.

The Trained Eye Knows

To the trained eye incomplete reaction of the various gases is visible. The retina of the eye records heat wave-vibrations in colors ranging from 40,000 to 60,000 per second. Red is recorded at approximately 40,000 wave-vibrations per second. Slightly more than this number causes the retina to record orange. At approximately 60,000 the retina transmits violet, and if the retina could record or transmit a greater or lesser measure of wave in number and length we would, without doubt, be able to discern many more forms, hues, and colors.

When I look into a furnace that is *properly constructed* and in which disassociation and reaction is taking place as it should, I am filled with awe and astounded at the grandeur and beauty which I behold in the release of energy as the gases speed from vibration to vibration, from form to form, and from color to color. I experience the pathos of our great epic poems, the profound grandeur of muisc, and the beauty of the eternal force reflected in man. It is, therefore, with a full sense of man's relation to, and his essential control of all the factors necessary to complete furnace operation, that I give to you plant operators and your associates, the charge that it rests upon you and you alone to obtain a maximum fuel economy in the furnace.

As I have just stated, it is necessary in order to obtain a maximum fuel economy, to have a properly constructed furnace. Air required for the combustion of fuel should be preheated. This may be done and is accomplished in a number of different ways. The simplest form of preheating the air for combustion is by the installation of a properly designed furnace in the combustion chamber, forming with the furnace surface the lower part of the combustion chamber. Hollow wall construction has been used with more or less success. Preheaters to absorb heat from the ejected gases gives a maximum fuel efficiency for boilers and such like applications of high temperature gases. The furnace installed in the cambustion chamber and placed immediately below the burner flame under the grate line, where it absorbs the radiating waste heat of the burner flame and utilizes it to preheat the air required for combustion to almost ignition point before admitting it to the burner chamber, should be so constructed to admit the air to the flame in cross vanes, as far as possible. Under these conditions the air is mechanically mixed with the finely atomized oil globules and, because of the high heat, it accelerates the vaporization and the combustion of oil.

Possible Efficiency

The same, in a large measure, is true of natural gas. The gases for combustion obtained with the proper floor furnace, being more uniform and less diluted with excess air, are of richer mixture and require less space for complete combustion or release of energy, and permit better heat absorption by the boiler.

With such type of furnace construction it is not difficult to obtain and maintain with modern boilers, from 82 per cent to 83 per cent combined boiler and furnace efficiency.

Entirely too much stress in the past has been laid upon oil burners. The term oil burner and its general application has led many otherwise competent men far afield. *The mixing and burning is done in the furnace.* It is quite important to have the proper shape and size burner to suit the particular installation or use. The difference shown between the various oil burners would largely disappear if the correct furnace for each could be arranged, for the important point is what happens after the oil gets into the furnace.

A given quantity of oil requires a given quantity of air for correct combustion, but the air should be preheated *or properly conditioned* and *properly introduced* to its affinity in order to obtain complete reaction within a minimum of time and space. In the combustion of an oil particle, it is the carbon that is more difficult to burn, for it separates out as soot at the slightest provocation and this causes much heat loss. This may happen due to a chill as meeting with the boiler tubes, or a lack of air at the right moment, and does happen where cold air in place of preheated air is constantly admitted to the furnace. This separating out as soot may occur without the slightest indication in the usual flue gas analysis.

Test Essential

In the proper study and flue gas analysis it will be noted there is a great heat loss occurring at times, even when there is plenty of CO^2 and no CO. Samples may appear showing a trace of CO and at the same time the heat loss due to soot is less. In general, however, along with CO and low CO^2, loss due to the soot may be anticipated. In ordinary testing practice the special equipment necessary to determine the soot loss is not always available and, in fact, it is a very rare thing to find a CO^2 disciple who can analyze for you or tell you anything about soot loss. The soot loss appears in the heat balance as a high, unaccounted for loss. The analysis of the products of combustion without the soot factor being taken into consideration may lead, and does lead to false conceptions, particularly in the proper design of furnaces.

For each furnace arrangement there is a certain percentage of CO^2 that gives the best results. The rule of adjusting burners to secure a slight haze of smoke may, at times, be quite wrong, as this smoke haze can frequently be secured with various percentages of CO^2 from the some furnace. Furnaces in which the carbon of the oil contnually tends to *drop out as soot, often give greater overall efficiency with considerable excess air.*

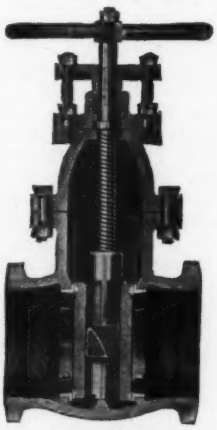
The exact way of establishing the correct CO^2 for a furnace is by a test where the oil and water is weighed. The furnace that permits the burning of fuel oil in a restricted fire box or under a boiler, which requires the least time to complete combustion, will give the highest fuel economy for such a furnace. The basic advantage of rapid combustion obtained

IRON BODY *with* PARALLEL SEATS

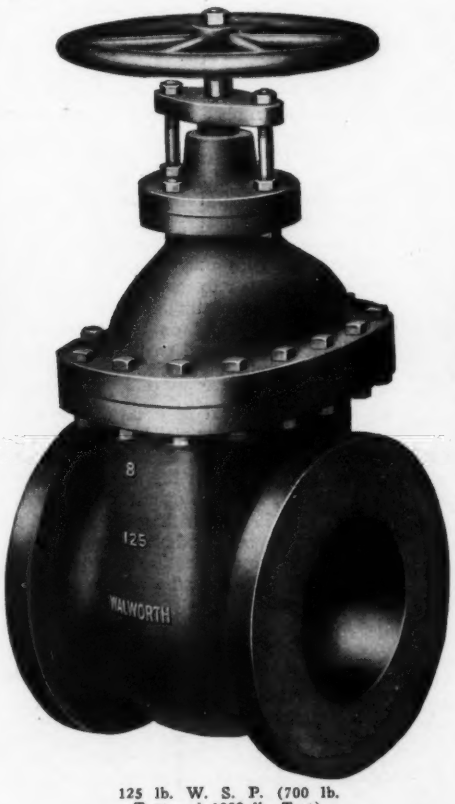
WALWORTH DOUBLE DISC VALVES

The double discs of this Walworth valve are designed to release instantly and keep clear of the seat until the instant of closing, when they are moved apart by a spreading device. The discs are always in alignment whether the valve is upright or horizontal.

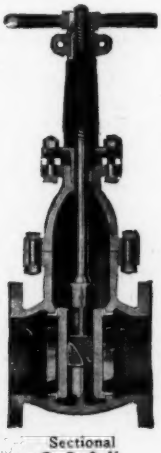
These Walworth valves are suitable for almost any service in which an iron body valve may be specified. For all refinery and pipe line service, especially, the interchangeable disc is an important feature, as it facilitates repairs.



Sectional N. R. S.
SCREWED



125 lb. W. S. P. (700 lb. Test and 1000 lb. Test)



Sectional
O. S. & Y.
FLANGED

WALWORTH CO., General Sales Offices: 51 East 42nd St., New York

Plants at Boston, Kewanee, Ill.; Greensburg, Pa., and Attalla, Ala.

WALWORTH INTERNATIONAL CO., New York., Foreign Representative

WALWORTH

"WHATEVER YOU BUILD, YOU NEED WALWORTH"

Valves, Fittings and Tools for Steam, Water, Gas, Oil and Air

Mention Where You Saw the Advertisement

by preheating the air which results in higher disassociation temperature, greater luminosity, and effective retaining of the heat and with efficiently and uniformly distributed furnace temperature, will give the highest fuel economy.

The solution of the problem of furnace fuel economy in boilers and furnaces where high temperature heat applications are desirable, *lies in the study of furnace construction, and will be obtained through this means only, when coupled with a competent plant manager and competent operators.*

The high temperature furnace operation about which I have been talking is different from the low temperature furnace application of heat. Therefore I will now dwell briefly upon the proper and effective application of heat under low temperature.

Heat and Cracking

The relation of heat application in the treatment of oil has hitherto been more or less ignored. It has long been apparent to my mind that the cardinal factor in all cracking processes is the application of heat, or I should say, the proper and effective application of heat. In developing different processes, machines, and apparatus for the cracking of oils, this most vital principle of the precesses has been generally overlooked.

In most cases, a rather peculiar type of mind seems to have been at work in the development of the various cracking processes. The minds at work on the subject in most instances, as I have just stated, seem to be filled with fear that an outsider be called in to diagnose their troubles. This fear, this uncertainty of mind in perfecting machines for the purpose of extracting a greater quantity of gasoline from petroleum products, has resulted in unfinished development of the various processes and in turn, in many cases licensees have found that the excessive fuel consumption prohibits the operation of cracking units under the slightest adverse market conditions.

Various designs of furnaces adopted in all of the important cracking processes making gasoline, may be generally classified as direct and indirect heat applications.

It has long been an established fact that medium furnace temperature is the prime requisite in the application of heat to a cracking unit. To secure medium temperatures and volume of the gases of combustion entering the vaporizer where the oil is to be treated, it is apparent that it was necessary to dilute the products of combustion. In part this was done by adding large volumes of excess air with the fuel. This method of operation resulted in great fuel waste and losses to the licensee. However, with this wasteful method, medium temperatures of gases such as are required in pipe stills and cracking units, were obtained, and the volume maintained. However, furnace troubles and heat problems continue to roll up on the operators, without end.

Development

You will realize that under these conditions and hap-hazard furnace construction such as were used in the various processes, uneven distribution of heat and the commingling or joint application of heat by convection and by ray, cause hot spots at different points throughout the vaporizors, which necessitated in most cases, the providing of means to shield the oil treating tubes from radiant heat. This resulted in what I may term the "indirect method or application." This indirect application of heat was accomplished by constructing a chamber for the vaporizing elements, and separating it from the furnace chamber by vertical wall or walls. This method of heat application resulted in greatly reducing the radiant heat, as did the perforated arch in the direct system, but the high fuel cost and the high maintenance cost still prevailed.

All of these efforts were commendable to a greater or lesser degree, as the goal they were working toward was the elimination of radiant heat and the obtaining of transfer of heat of gases into the oil being treated, as far as possible, by means of convection and conduction. In order to obtain the high velocity required and to obtain the work from the heating surface exposed to the gases, or the proper transfer of heat or amount of heat to the product being treated, it was necessary to eject the gases to the stack at high temperatures varying from 650 to 1000 degrees Fahrenheit. These temperatures, as you know, accounted for the wasteful operation, and the high velocities under natural draft accounted for the hitherto low heat transfer per square foot of heating surface. As the gas came into contact with only one side of the tubes, an endeavor to raise the heat transfer was made by putting rings, or fins, in a corrugated manner on the tubes, but this experiment proved costly and expensive, and by reducing thus the travel of oil through the tube and the time of the heat application, defeated in a large measure the possible result for which everyone was striving to attain. The whole industry was in a rut as far as the matter of furnace development and operation was concerned, and it was with great difficulty that they have been and are being aroused to the prime importance in refinery operations of the proper and effective application of heat.

Only Heat Application

I maintain that the cracking of oils is simply a matter of heat application made in a proper manner and under the proper duration of time. There is no mystery about the reaction and the disassociation of the various products. You are told by some who theorize, that certain very definite things take place under different pressure conditions in the cracking of Hydro-Carbons—they split off here or there, but recently an entirely new series of reactions and formations have been discovered which I predict will prove the fallacy of the theories under which some cracking experts, so called, have been laboring for years.

The need of mild temperatures and large volumes of combustion gases for the treatment of oil in pipe stills and cracking units has been apparent to me for a long time. Therefore, a long period has been spent in studying and working to meet these requirements. Time does not permit me to present the facts pertaining to the labor and money expended in my continued efforts to solve the problem. A great deal of moral courage is required for one to blaze a new trail, to introduce a new idea or way, or form a new path.

Keep Going

Here I am reminded of a scene that occurred long ago in Germany. A little circle of psychologists were gathered together in the early twilight hours of the evening. A young radical was invited to this meeting and asked to lay his proposition of the *dualism of mans' mind* before the gathering. He did so, briefly, and a long battle of words and arguments ensued, the old school of psycologists fighting for the system they had set up. Finally, when they could not answer the arguments of the young Doctor, in the wee hours of the morning the leader of the old school arose, a striking figure with a long white beard, and said in substance, "Brothers, this is not so, and if it were so we could not admit it to be so, for it would unseat our entire system of psycology."

In your industry the long bearded theorists, the men with the orsat would hold you back from the path of progress, ever declaring that facts are failures, but I urge you to go forward in the new path and new way of truth, remembering this, that circulation is necessary to life in every form.

The recirculation of combustion gases applied to cracking units reduces the fuel costs, reduces the maintenance cost, and gives a greater heat transfer per square foot of heating surface or a proper heat input per pound of oil being treated.

Results Above Theories

Let us analyze for a moment the principles of the recirculating of combustion gases in vaporizing units. As I have indicated, a large or sufficient volume of gas, generated and properly tempered in the furnace, is necessary in order to make a proper and effective application of heat to oil vaporizers. The application of heat is made by the speed and spread of the gases travelling through the vaporizors. It is readily seen that under these conditions without recirculating the gases or re-introducing the gases to the combustion chamber in large quantities, it is necessary to eject from 40 to 50 per cent of the total heat input in the gases to the stack, but with recirculation the volume of gas in the unit is easily brought up to a much greater quantity than it is possible to draw off from the vaporizor by natural draft. In proportion to the velocity of gases passing over the heating surface, ring structures are removed from the heating surface. This is a very important function. By means of recirculation, and the proper application thereof to a properly constructed vaporizor, a uniform, or practically uniform heat input for the entire circumference of the tube is assured. In other words a great volume maintained, filling the entire chamber, surrounding the vaporizing elements and moving at a high velocity under a slight pressure, makes it possible for you to ob-

(Continued on page 114)

Bubble Towers

In repeat orders are indicative of merit—

Winkler and Koch Bubble Decks—

1—give absolute separation on any type of operation.

2—increase yields materially.

3—completely eliminate re-running.

4—effect a considerable fuel saving.

5—are made of cast iron throughout to resist severe corrosive conditions.

6—can be installed in existing tower shells.

Number of Towers on Initial Order	Number of Towers on Repeat Orders	Additional Repeat Orders
4	4	1
2	1	
1	3	
2	1	
1	1	
3	1	1
2	1	
4	2	
4	1	
4	2	
1	1	
5	3	
2	1	
2	5	2
2	1	1
11	1	
3	1	1

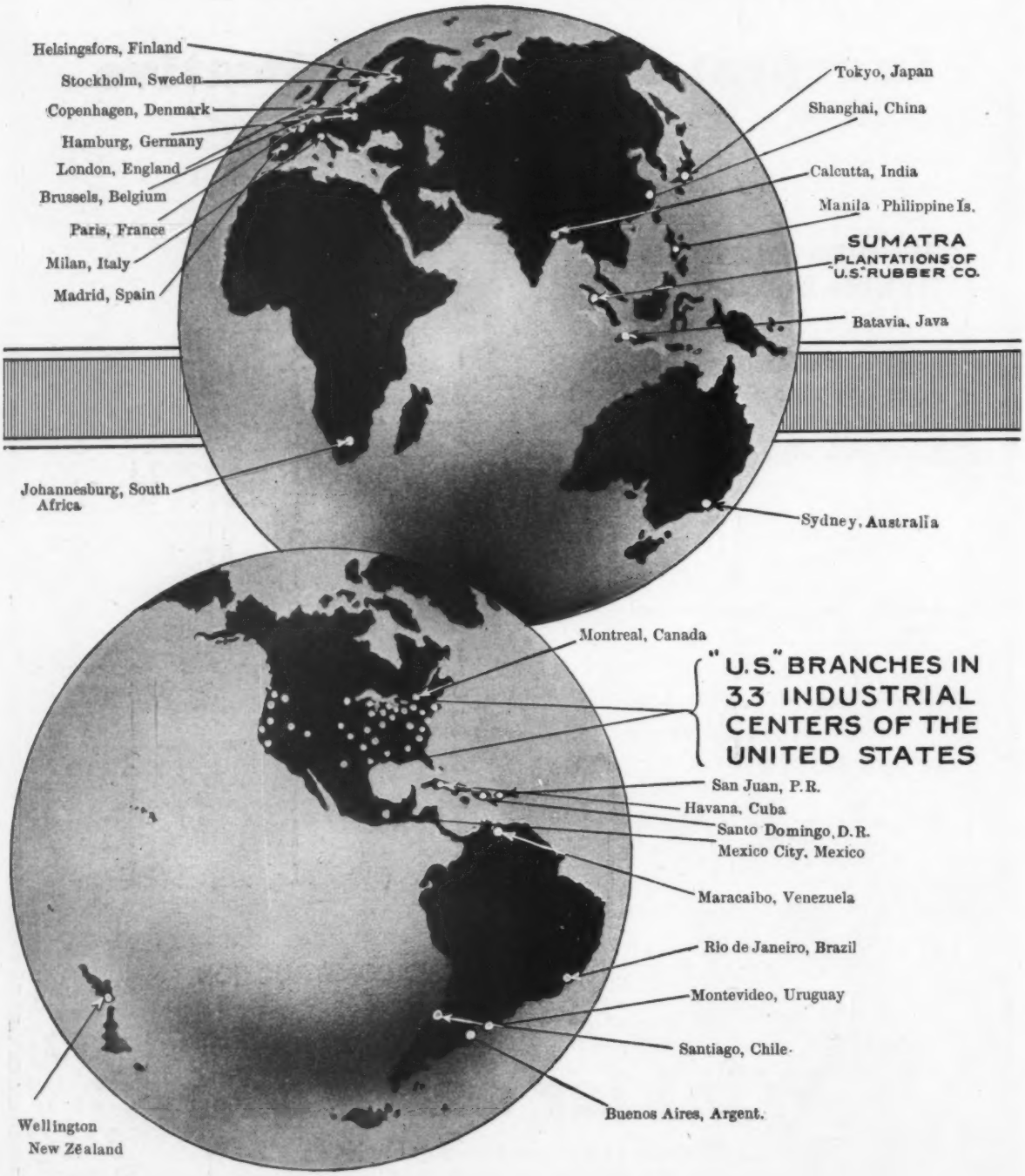
GENERAL REFINERY DESIGN AND CONSTRUCTION
PIPE STILLS

Winkler and Koch

Consulting and Constructing Engineers
Fourth National Bank Building

Wichita, Kansas

"U.S." Service Covers



"U.S." Mechanical

Mention Where You Saw the Advertisement

the World—

Mechanical Rubber Goods for Every Industrial Need

ALL over the world—in South African Gold Mines—in the nitrate fields of Chile — on construction work in New York City — in the oil fields of Texas and Oklahoma—wherever the wheels of industry move, the "U. S." Trade Mark, quality stamp of the United States Rubber Company, is recognized as a guarantee of greater service and dependability on Mechanical Rubber Goods.

The "U. S." Line is the perfected result of over 75 years' experience in the manufacture of Mechanical Rubber Goods for industrial service. Miles of "U. S." Conveyor Belting are carrying materials in every part of the world — thousands of pulley wheels are driven by "U. S." Transmission Belting— "U. S." Packings are known for their unfailing service in engine rooms from Bombay to Barcelona. Oil hose, water hose, steam hose—there's a special type of "U. S." Hose for every service.

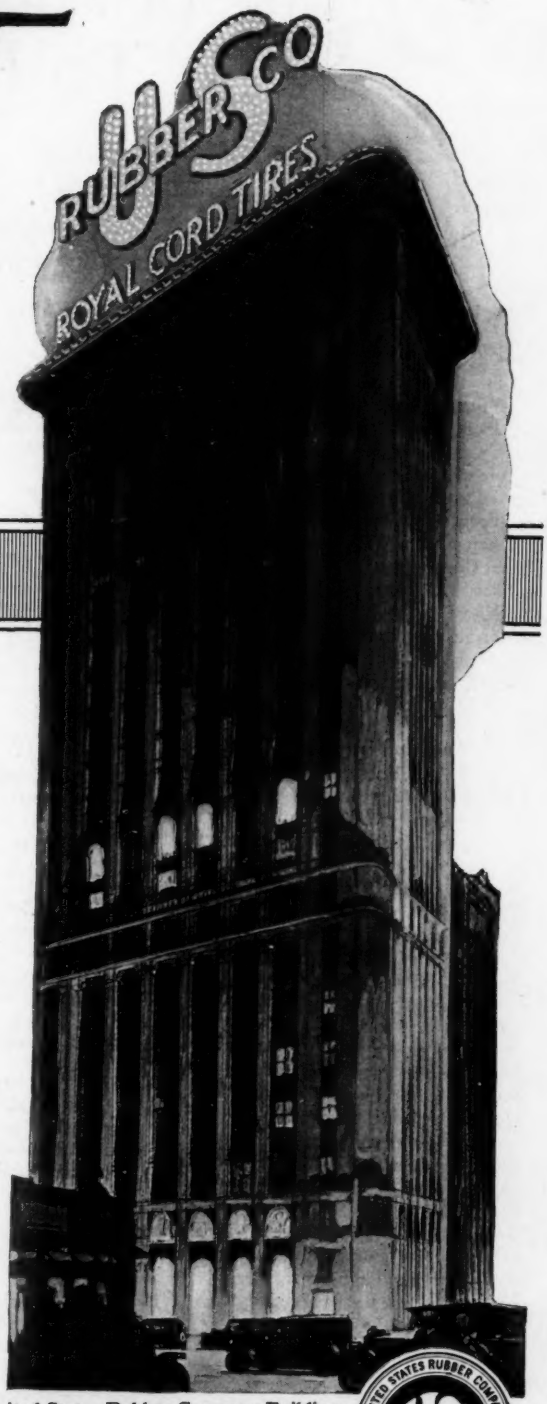
If it's made of rubber you can get it from a "U. S." Branch.

"U. S." Sales Engineers in every part of the world are ready to serve you. Make use of their experience and advice when you buy Mechanical Rubber Goods.

United States Rubber Company

1790 Broadway New York City

Branches in every industrial center



United States Rubber Company Building, New York City, headquarters of the world's largest grower, manufacturer and distributor of rubber and its products.

Rubber Goods

Trade Mark

Mention Where You Saw the Advertisement

Progress of Fuel Economy Credit To Refiners

Paper presented before group meeting of the Western Petroleum Refiners Association, Wichita Falls, January 17-18, 1927

By JOHN THOEN,
Combustion Engineer, Marland Refining Company

THE increased interest in fuel economy among refiners and the progress made along that line within the space of a few years are significant of a progressive attitude reflecting no little credit upon the industry. The rapid evolution and improvement of the manufacturing processes naturally resulted automatically in more economical operation and at the same time it has saved the refiner from the danger of too great conservatism which would otherwise have a tendency to make him distrust innovations on general principles.

Fuel economy, generally speaking, is desired because it means dollar economy—lower costs. But there are other advantages. It will not do to forget about fuel economy because the fuel costs little. Economy is synonymous with efficiency and efficiency means no lost motion, good appearance, order, cleanliness, and convenience. Fuel economy means efficient apparatus, efficient operators, efficient supervision and efficient records.

Of primary importance is reliable knowledge of what is going on. Readings of daily quantities of fuel used throughout the plant and in each department and quantities processed are a part of every refinery routine. But to enable the executive to have at hand data enabling him to judge the value of present or proposed equipment from a fuel economy standpoint, special figures and estimates are required. At the start, these data are obtained by special tests. Such tests are often repeated until it is found advisable to keep the instruments and test equipment in permanent operation. Recording instruments are added and considered standard equipment on future units. It is soon found necessary to keep a tester occupied in keeping these instruments in operation and repair. A small, well organized force, responsible for the correctness, operation and maintenance of test instruments, will pay its cost many times over. Many kinds of equipment, as you know, carry a guarantee of performance. Very often it is very important to know if the performance is as guaranteed and checks on such equipment give information of the greatest value. If the efficiency of a pump or furnace installation is found very low, it may be the fault of the manufacturer or the operator, or neither; in any case the need of correction is discovered.

Generally speaking, fuel economy can be obtained in refineries as follows:

1. Increased furnace efficiency.
2. Waste heat recovery.
3. Power economy.
4. Process steam economy.
5. Process heat exchanges and continuity of operation.

Under the first head,—furnace efficiency, are included principles with which most of you are familiar enough and I need not go into detail. High CO_2 is the proverbial formula. You have had the wonders of CO_2 recorders expounded to you and probably used them for years. It is first necessary to find out what CO_2 can be obtained with the equipment with good operation. Some types of stills require considerable excess air for maintaining safely low furnace temperatures. Here gas circulating systems have their application and have found wide acceptance. The principal problem involved with this apparatus is maintenance costs. Future developments will probably include increased mechanical efficiency. They are used at Ponca City on Dubbs stills and give a material increase in capacity and fuel economy.

Proper Furnace Design

The burner and furnace must be properly designed to give best results and it is often found the high CO_2 cannot be obtained by simply closing down on the damper. Incomplete combustion and excess air may be found at the same time, due to faulty construction. Under stills, furnaces must sometimes, with batch operation, be designed to carry widely varying rates of combustion. This means frequent damper regulation and emphasizes the value of continuous operation. Pipe stills may, during a whole run, be fired without changing the damper and still maintain a high uniform CO_2. Boiler practice has been standardized for a long time and there is little excuse for bad combustion conditions and in most power plants, good conditions are found.

Incomplete combustion or CO_2 loss is rarely found except with faulty gas burners. With oil CO is generally accompanied by dense smoke, a condition that calls for immediate correction in itself.

Before leaving the topic of furnaces, a word should be said about special designs. One of these, of which there are several makes, is constructed with tunnels of ordinary or special refractories. The flame is confined within the tunnel where high temperatures obtain and a greater uniformity of heat distribution results. We have found that with such furnaces there may be CO formation without smoke, due to extreme temperatures. We are prepared to say that this type of construction always gives better fuel economy. They do however greatly reduce the possibility of one source of waste not heretofore touched upon, i.e. incomplete combustion of fuel oil due to low furnace temperatures. When it is necessary to maintain small fires in large furnace volumes, some of the atomized oil can pass almost undetected to the stack in the form of vapor. A high concentration of this vapor will appear as a yellow haze from the stack.

The flue gases from the furnaces, particularly at the stills, carry away a large quantity of heat. Boiler gas economizers have been used extensively in power plants where fuel costs are moderately high but their high cost often makes them a doubtful business proposition where fuel is cheaper and stack temperatures not excessive.

Practically all mid-continent plants have as part of their equipment, the old style of shell stills. When these are heavily fired and run at high capacities, as is the case with our light oil stills, the flue gas temperatures may average as high as 1250 degrees. Economizers in the batteries at Ponca City reduce the flue gas temperature to about 650 degrees and raise the crude preheat temperature 100 degrees. It would take about 40 barrels per day additional fuel to obtain this heat transfer by means of the shell still furnaces.

Fuel circulating systems have already been mentioned. Air preheaters are now rapidly coming to the fore, but are generally expensive and should probably be considered as one of the last refinements in a plant so subject to changes as the modern refinery.

Boiler Plant

Economy in the refinery boiler plant differs from central station practice

$50.00 a year per Boiler Horsepower *Waiting to be saved*

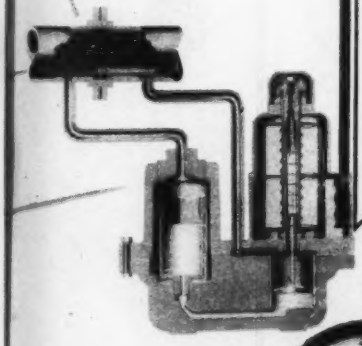
SUCH was the startling declaration of a prominent engineer at a recent convention of leading executives of one of America's greatest industries. He cited exhaustive data to prove that the average large plant in this industry is losing more than $600,000 a year—about $50 a boiler horsepower—through *avoidable* waste in the production and use of steam.

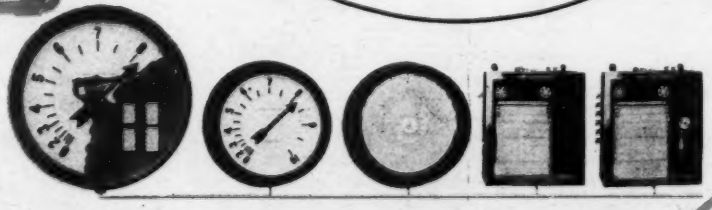
Requests by steam plant operators for needed instruments should never be vetoed by managers and superintendents for low steam costs are linked with an adequate boiler room equipment of flow meters, CO_2 meters, flue gas pyrometers, draft gauges, etc.

FLOW METERS THE FIRST STEP

Flow meters tell operators what their boilers are doing—guide them in efficiently distributing steam load—stop blind use of an excessive number of units—improve efficiency and often save the cost of a boiler.

Secure the advantages that only BROWN ELECTRIC FLOW METERS—operating on the *inductance bridge* principle—can give. What these advantages mean to steam plants and other services requiring measurements of steam, water, air or gas are outlined on the other side of this sheet, and covered in detail in a new book—"The Brown Electric Flow Meter" now ready for distribution. Write for a copy. Use the coupon below.





To Measure is to Economize—Pascal

The New **Brown Electric Flow Meter**
on the Inductance Bridge Principle

The Brown Instrument Company,
Wayne & Windrim Avenues,
Philadelphia, Pa.

Please send me a copy of your Catalog No. 20 describing the new BROWN ELECTRIC FLOW METER.

Name_____

Title_____

Company_____

Address_____

Give your plant *this better flow meter*

ALMOST any good flow meter will pay for itself in a year—often several times over. But give your plant operators the *extra* flow meter advantages obtainable only with the Brown Electric Flow Meter, operating on the ***inductance bridge*** principle.

Give them the flow meter dependability that comes with the Brown Electric Flow Meter, freedom from make-and-break contacts — absence of electrical conductors or rotating parts in the manometer pressure chamber—independence of voltage fluctuations, without either voltage regulator or compensator—the positive, accurate long-distance operation made possible by the use of the ***inductance bridge*** circuit.

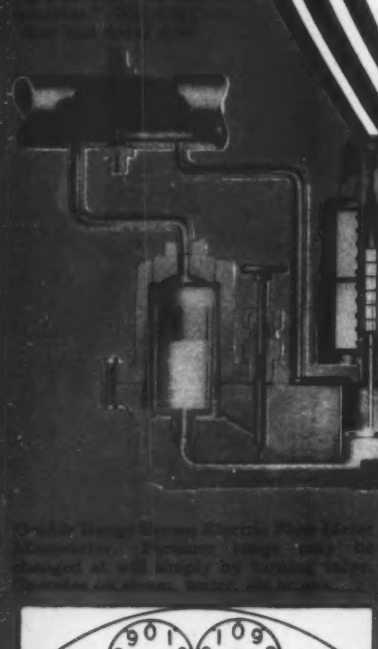
Give your men the advantages of the Brown easy-reading, five-figure integrator—the unique automatic recording planimeter, choice of circular-chart or strip-chart recorders—all features original with the Brown Electric Flow Meter line.

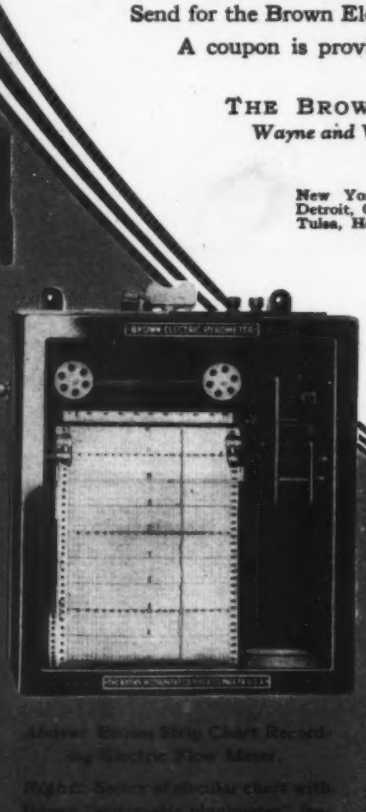
Send for the Brown Electric Flow Meter Catalog No. 20.

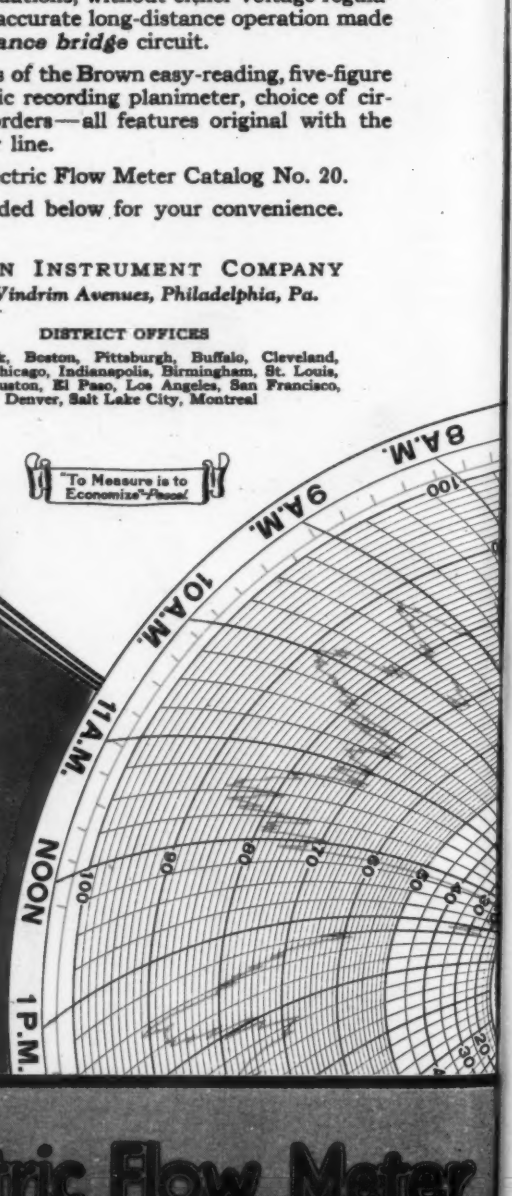
A coupon is provided below for your convenience.

THE BROWN INSTRUMENT COMPANY
Wayne and Windrim Avenues, Philadelphia, Pa.

DISTRICT OFFICES
New York, Boston, Pittsburgh, Buffalo, Cleveland, Detroit, Chicago, Indianapolis, Birmingham, St. Louis, Tulsa, Houston, El Paso, Los Angeles, San Francisco, Denver, Salt Lake City, Montreal







"To Measure is to Economize"—Peace

The Brown Instrument Company,
Wayne & Windrim Avenues,
Philadelphia, Pa.

Please send me Catalog No. 20 describing the new BROWN ELECTRIC FLOW METER operating on the inductance bridge principle.

Name_____

Title_____

Company_____

Address_____

The New **Brown Electric Flow Meter**
on the Inductance Bridge Principle

in some respects. In our case at the Marland Refinery, we are equipped to handle four kinds of fuel, gas, oil, sludge and coke. The sludge from the lubricating agitators after being treated for acid recovery, has been successfully burned by mixing with coke, on travelling grate stokers. The nature of the sludge is such that while high efficiencies cannot be obtained with this particular equipment, the saving in fuel cost is almost 100 per cent of the quantity consumed, as provision for hauling and storing the material is an expensive item. Experimenting will continue on this problem until a higher efficiency is attained for sludge burning is no exception to the rule that the only good way is the efficient way.

A promising development along this line is a special sludge burner now being used at the Roxana Refinery at Woodriver, Ill. This burner has been designed to overcome the principal difficulty in burning straight sludge, its tendency to fuse together which necessitates continuous agitation or stirring. The burner is a rotary drum into which the sludge is fed by a screw and air admitted into the revolving chamber by means of a fan. This is probably one of the latest developments in combustion apparatus for a fuel which only very lately has been given serious consideration by burner manufacturers.

The matter of burning petroleum coke is also in a stage of development which is far from complete but this problem is comparatively simple. The increased production of pressure still coke at the Marland plant made it imperative to find a fairly large means of consumption and in addition to the stoker mentioned, two unit pulverizers were installed serving two 550 H. P. boilers. Except for a little difficulty at the start in adapting a machine designed for coal to properly handle and burn the coke, the venture has been quite successful. Due to the low amount of volatile matter in this fuel, a high furnace temperature must be maintained to insure ignition and low excess air is also essential. The boiler efficiency obtained is fully as good as with gas or oil. Furnace maintenance, however, is higher, due to erosion of the brickwork. There is also an increased amount of fouling of the tubes and depositing of fly ash or fine cinders in the boiler passes.

With stills and boilers operating efficiently, there remain great possibilities of fuel economy in the application of steam and power throughout the plant. The marked difference between the operating systems of various plants makes it difficult to prescribe detailed improvements beyond the well known essentials of good design and insulation of steam lines, etc., and I will therefore discuss a few possibilities based on general plant arrangement such as the Marland Refinery.

The boiler delivers about 300,000 pounds of steam per hour to nine distributing lines, two of these lines to the electrical plant, one serving a battery of pressure stills, one to two other batteries, one each to the crude and light oil distillation area, lubricating stills, lubricating processing departments, and wax plants. Each line is metered at the boiler house and several of the department units are metered. One great advantage in metering is the effect it has on securing the cooperation of the department foreman or superintendent in reducing wastes. The results obtained by a little care in handling steam, installation of traps, etc., and keeping the lines in good repair, are soon made evident.

Usually a good many pumps are used in every department and exhaust steam is often discharged to the air. This means a great heat loss and the logical procedure is the installation of a complete exhaust system for collecting this heat and utilizing it for heating purposes, tank coils, building heating, feedwater heating, oil preheating and agitation in stills are some of the applications. By the time this steam is condensed, both the energy and the heat have been utilized. By providing a large demand for low pressure steam, a low power cost can be maintained and where electric current is produced the type of turbine to be used is of the greatest importance. Condensing turbines with low water rates are not necessarily economical if back pressure turbines can resell their steam to some other departments. As an example, if a certain process requires for heating 75 pounds of high pressure steam and a condensing turbine is used which requires about 20 pounds of steam to produce a kilowatt hour, the process unit will get the same amount of heat from 80 pounds of exhaust steam as it gets from the high pressure 75 pounds and the turbine, if operated non-condensing, may use 85 pounds to produce a KWH, but will send back at least 80 pounds of exhaust. Thus, instead of a total of 75+20 or 95 pounds total steam expended, there will be only 85 pounds or a saving of half the steam used for power. Exhaust systems are operated at from 5 to 20 pounds pressure, depending on heating requirements, line capacites, etc. Sometimes higher pressures are required. In our case a large amount of process steam could be used at 40 pounds pressure and two extraction or bleeder turbine were installed equipped with surface condensers to allow full load operation regardless of the amount bled. This is a decided advantage over the straight back pressure type, as the latter carries a load in proportion to the amount of steam delivered and thus is not adapted to automatic regulation. With the bleeder type, an automatic valve admits steam to the system from the space between the first and second stages, according to the demand, and the full generating load is maintained by more steam being automatically admitted to the condensing stages.

Exhaust Steam

The 40-pound steam is used for agitation on all lubricating stills requiring the largest quantities of steam, particularly the bright stock stills. It is also used for heating weak acid preparatory to going to the concentrators, and by means of a reducing valve, it maintains a constant pressure in the exhaust system. When bleeding 35,000 pounds per hour in this manner, the water rate chargeable to the turbines is reduced from 19 pounds to about 15 pounds or 21 per cent.

Such improvements lose their effect at once if exhaust steam is allowed to escape from pumps, engines or relief valve, hence the importance of a demand in excess of the normal supply and a balancing of the difference by feeding in with a regulating valve. This balancing quantity should, however, be kept as low as possible as a reducing valve dissipates the available energy in the steam.

The system now being completed, at Ponca City, of which the above are a part, also includes the substitution of exhaust for high pressure steam for agitation in all the crude stills and some of the lube stills. This will reduce the available exhaust steam supply and increase the demand which will again be reduced by preheating the boiler feed water before it reaches the treating plant. This preheat will be accomplished by absorbing the steam vented from the lube still condenser boxes. An open heater for this service will operate at a slight vacuum, using water from the overflow of the condenser boxes. The water will thus be pre-heated to some extent before reaching the steam. It is expected that an average of about 80 b.t.u.'s per pound of feed water will be recovered, which would mean a reduced steam demand at the final heater of about 14,000 pounds per hour.

Where a plant covers considerable ground, steam transmission lines from a central boiler house are often so long that there is serious loss both in pressure and superheat. The advantages and disadvantages of separate boiler houses checked against this condition will sometimes throw the balance for and sometimes against decentralizing. In the case of our pressure still extensions, we had the problem of transporting steam to run the turbine driven centrifugal hot oil pumps for the Dubbs stills and the calculated pressure drop through nearly 2000 feet of line presented a serious difficulty. We, therefore, installed a barometric condenser serving this unit, thereby reducing the steam consumption approximately one-half. In this way of handling the problem there is, of course, a loss of the latent heat, but to offset this we have avoided the

necessity of a much greater investment in an additional boiler plant.

Heat Evchangers

To get the most service out of steam it is necessary to carry a continuous campaign for checking losses and analyzing power and heating consumption. Some of the common steam wastes are: leaks, poor insulation, lines left under pressure after service from them has been discontinued, oversized lines, undersized lines, etc. Very often steam is used for such purposes as what is called atomizing gas in gas burners. Atomizing gas seems to me a procedure similar to spiking alcohol. Steam jets for ventilation are often inefficient and left in use after they are no longer required.

Perhaps the greatest and most interesting development in heat saving is he increased use of heat exchangers of all sorts used on stills. Pipe-stills designed for continuous operation, now used everywhere, illustrate the value of continuous apparatus. Better control, higher capacities, lower fuel consumption are the outsanding features. When a finished product in any manufacturing process contains no more heat units than the raw, it is only necessary to develop the design towards an ideal point where the heat is made to travel in a cycle and require no makeup. In practice, it is, of course, impossible to reach such a point, but the possibilities are not exhausted until the makeup introduced in the furnace is equivalent to the radiation losses plus a reasonable amount of heat carried away by cooling water, etc., at temperatures too low for practical heat exchanger application. Low temperatures and large quantities sum up to huge b. t. u. totals which are hard to recover. One of the ways possible is the method described above relative to feed water preheating but the water used thus can only represent a small percentage of total. This leads to the consideration of less water expenditure leaving only one possibility—more exchangers.

The equipment on a new pipe still at Ponca City combines some of the latest developments along this line. The crude enters through a series of exchangers cooling and condensing in turn all the cuts from the higher to the lower gravities. Before entering the pipestill, it passes through the residium coolers and is raised to a high enough temperature to be discharged into a flash tower and the vapors from this tower go through the first exchanger. All this heat exchange reduces the furnace demand and the fuel consumption as compared with the old type stills with economizers, is approximately one-half per barrel crude charged. In addition to direct fuel saving, the heat absorbed in the exchangers reduces cooling water requirements in proportion.

In other departments heat exchangers are used on vapor lines and still pumpout lines, preheating still charges for continuous and batch operation both. As such apparatus is fairly dependable in results, easy to operate, save time and increase capacities, they should be applied wherever there is an opportunity. They are as a rule suitable for use with any ordinary medium and do not necessarily represent a permanent investment against any department where changed conditions make them inapplicable.

Steam heat exchangers require more attention than do vapor or oil exchangers. For higher temperatures, high pressure steam must be used and properly trapped and the condensate properly disposed of.

The matter of condensate returns to the boilers merits close attention. While the direct heat and fuel saving does not amount to a large item, when combined with other desirable advantages in using condensate, it more than justifies the expense of whatever equipment is needed. An underground system for collecting condensate from traps of all kinds requires little attention after it is installed. It should gravitate to a central basin from which the water may be pumped back to the feed water heater. The re-evaporation from the water discharged from a trap at higher than atmospheric pressure is usually condensed again before reaching the hotwell and helps maintain the temperature at very near 200 degrees. If the pump discharge line to the heater is well insulated, further loss should be quite low and little steam is required to bring the water to the final feed water temperatures. In our case the temperature of the condensate is about 90 degrees higher than our ordinary raw water supply and by returning only an average of 12½ per cent of the steam delivered to a group of departments, we save by this means the equivalent of a million pounds of steam per month, worth approximately $250.

Water

The lubricating departments use a considerable amount of water in processing and require it free from impurities. This reduces the amount available for returns, but by making the best possible arrangements, a return of around 40 or 50 per cent of the total steam can be obtained in many plants. Besides the fuel saving there is the saving in chemicals for water treating, the amount per thousand gallons depending on the hardness of the raw water. Soda ash and lime treatment with fairly hard water costs 7 to 8 cents per 1000 gallons and on this basis the value of the above returns would be $120 per month.

Lower boiler water concentrations with consequent reduction in blow down and ability to operate boilers at higher ratings are also among the advantages.

There remain to be mentioned a few specialties which we have been using for some time with good success. Automatic control of heating processes have many applications. One of these is control of wax sweating. Hand control has always been difficult and automatic controllers have speeded up the process and reduced the steam consumption. Controllers for pressure, tower temperatures, flow, etc., are also used and have some indirect influence on fuel consumption, but are of value mostly as a help to the operator in producing a uniform product.

Boilers with priming tendencies are equipped with steam separators or purifiers in the drum which prevent the carrying over of boiler water into the superheaters and steam lines.

The subjects covered deal mostly with equipment and design of apparatus and their possibilities. Actual results depend on the attention given such apparatus and the interest taken therein by the management and the operators. It cannot be denied that much valuable machinery is bought and paid for and never given an opprtunity to serve its purpose to the fullest extent. Records and regualr reports must be so devised as to give immediate indication of faulty operation, so that steps can be taken to correct the trouble. Constant study of all heat operations will lead to the discovery of many opportunities for improvement, in fuel economy as well as in processing and while the final tendency will necessarily conform to the particular characteristics of the plant, the net results are a direct gain, not only to that plant but to the industry as a whole.

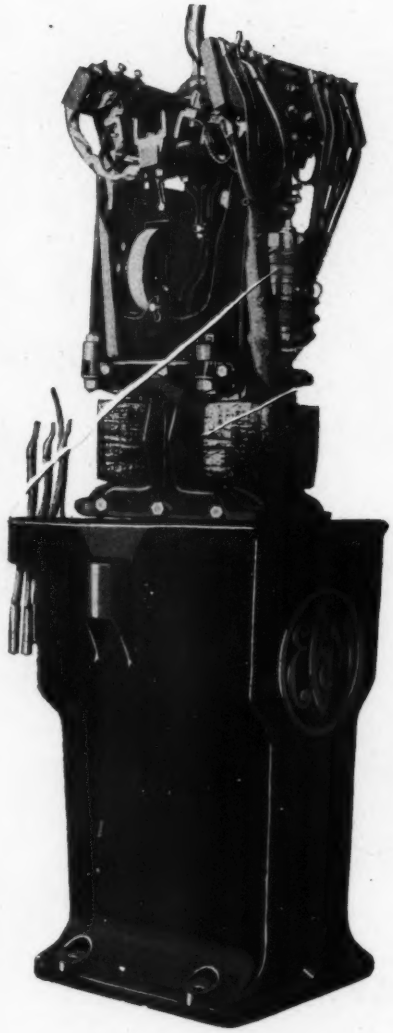
Skelly Shipments Show Large Gains for Year

Tulsa.—Tank car shipments of refined products and natural gasoline for the Skelly Oil Company reached 21,809 of which 3742 cars were natural gasoline.

Total carload shipments of Skelly products in December were 2092, compared with 1571 in December of 1925. Much of this substantial increase was due to the demand for the new Skelly "Refractionated" gasoline, which was put on the market early in December.

R. H. Carter has joined Elliott Company's Detroit District Office. Mr. Carter is an experienced construction and operating engineer, both marine and stationary. During the war, he was with the New York Shipbuilding Company at Hog Island; after the war, with the Munson Steamship Lines in South American passengership service as chief engineer. He has had considerable sales experience in the field of electrical equipment. Recently, he constructed and put in operation the new turbine station of the Illinois Steel Company at Gary, Indiana.

Oil-Immersed Starters eliminate electrical fire hazards



The EC&M Automatic Compensator is a push-button operated, oil-immersed starter for controlling A. C. motors. It is being installed in the oil industry for the control of motor-operated pumps in refineries, at loading stations and booster stations, and for general applications. It has all of its contacts and all working parts under oil, so there is no danger of an exposed electric flash which might cause a fire or an explosion.

This Compensator is pictured here. To the left is shown the method of lifting the working parts out of the oil.

The EC&M Automatic Compensator is oil-immersed because:

1. Oil-immersed means better arc breaking capacity, thus preventing internal short circuits and flash-overs.

2. Oil-immersed means that operating parts are kept in perfect condition and are protected against corrosion and rusting.

3. Oil-immersed means that maintenance is reduced to the inspection but twice a year of the contacts and oil level.

4. Oil-immersed means that the starters may be mounted anywhere, indoors or out, with complete safety. Separate control rooms or enclosures to isolate and protect the apparatus are not required.

5. Oil-immersed means: dust-proof, moisture-proof, acid-proof, flame-proof, explosion-proof.

In subsequent issues of this paper, we will picture how electric motors, large and small, are being controlled and protected by EC&M Oil-immersed Control Apparatus.

Bulletin 1042-F describes E C & M Automatic Compensators. Send for it.

THE ELECTRIC CONTROLLER & MFG. CO.

BIRMINGHAM-BROWN-MARX BLDG.
CHICAGO-CONWAY BLDG.
CINCINNATI-1ST NATIONAL BANK BLDG.
DETROIT-DIME BANK BLDG.
NEW YORK-50 CHURCH ST.
CLEVELAND, OHIO
LOS ANGELES-AMERICAN BANK BLDG.
SALT LAKE CITY-228 W. SO. TEMPLE
PHILADELPHIA-WITHERSPOON BLDG.
PITTSBURGH-OLIVER BLDG.
SAN FRANCISCO-CALL BUILDING
SEATTLE-570 COLMAN BLDG.
TORONTO-METROPOLITAN BLDG.

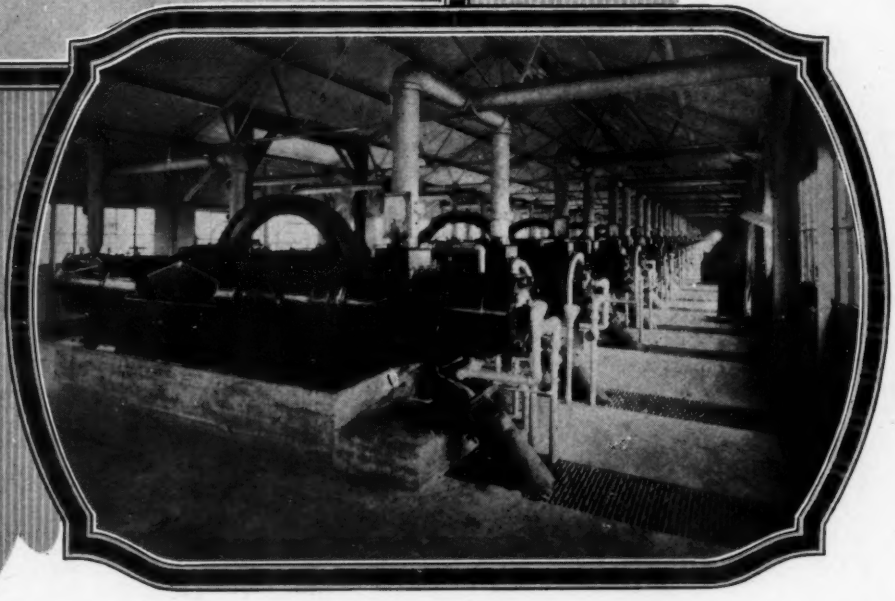
CLARK BROS. COMPANY

Olean, N. Y.

CLARK CON

Mention Where You Saw the Advertisement

Clark Bros. Co.
OLEAN, N. Y.



MPRESSOR
ION IN THE
E OF TEXAS

SALES AND SERVICE

Gas Engineering & Const. Company
125 West First St.
Tulsa, Oklahoma

Smith-Booth-Usher Company
228 S. Central Ave., Los Angeles
50 Freemont St., San Francisco

McCamey and Sweetwater, Texas

MPRESSORS

Mention Where You Saw the Advertisement

Bureau Makes Survey of Pipe Line And Storage Capacities

Inventory shows over 90,000 miles of line, averaging six-inch and total storage capacity of more than 800,000,000 barrels

By G. R. HOPKINS and A. B. COONS
(U. S. Bureau of Mines)

A SURVEY of the petroleum pipe lines by the Bureau of Mines as of May 1, 1926, shows that on that date there was a total of slightly more than 90,000 miles of pipe lines in the United States, having a capacity of approximately 15,750,000 barrels, which is equivalent to one-fourth of the nation's average production for one month. These lines varied in diameter from two to 16 inches, the weighted average being six inches.

The total pipe-line mileage was about equally divided between trunk lines and gathering lines, though the capacity of the former was about four times that of the latter. This was due, of course, to the difference in average diameter, that for the former being 7.4 inches as compared with 3.7 inches for the latter. The common size for trunk lines was eight inches, and for gathering lines two inches.

Oklahoma, with 19,180 miles of pipe lines, is the leading State in total mileage, with Texas second and Pennsylvania third. From point of trunk lines alone Texas is considerably ahead of any of the other States, a position which it owes to its size and to the growth in the movement to its Gulf ports. California, though the leading State from point of production, ranks only seventh in pipe-line mileage. This is due to the fortunate location of the Los Angeles Basin fields, some of which are within sight of the refineries to which their oil is delivered or of the port of San Pedro through which the oil is shipped.

The last survey of this nature, made in the spring of 1924 by the U. S. Geological Survey, recorded a total mileage of nearly 83,000 with a capacity of approximately 14,450,000 barrels. This indicates an increase of nine per cent in both mileage and capacity during the two years.

Storage Capacity

The grand total of tankage, exclusive of producers' storage at the wells, available in the United States for the storage of crude petroleum and of petroleum products at refineries on May 1, 1926, amounted to over 800,000,000 barrels of 42 U. S. gallons, which if confined to a square mile would cover it to a depth of 164 feet. This total is given as 815,994,000 barrels in the accompanying table but, owing to the fact that some types of crude storage equipment are moved from place to place as old fields decline and new fields come in, and also owing to new construction and abandonment of old construction, it is advisable to consider the total in round numbers only. A good illustration of this change is supplied by the Panhandle field, where several million barrels of storage have been erected since this survey was made, some of which was moved from other localities. This shifting character of crude storage to conform with new discoveries is also true of pipe lines, though to a less extent. The pipe lines of the United States have a capacity of 16,000,000 barrels, which, added to the tank capacity, makes a total of over 830,000,000 barrels.

On May 1, 1926, there were 530,000,000 barrels (net) of oil (410,000,000 barrels of crude petroleum and 120,000,000 barrels of refined oils) held in tank farms, in pipe lines, and at refineries. There was also approximately 20,000,000 barrels of B. S. and water involved in this storage, making a total of 550,000,000 barrels of liquid in storage, indicating utilization of 66 per cent of total capacity.

Of the total tank capacity nearly 500,000,000 barrels was at tank farms and over 300,000,000 barrels at refineries. Of the latter, 80,000,000 barrels was crude storage, hence the total available tankage for crude in the country on May 1, 1926, was approximately 580,000,000 barrels. If allowance is made for B. S. and water and for tankage not filled in general practice, there was on May 1, 1926, 140,000,000 barrels of unfilled crude storage available for use. The distribution of this unused capacity was, however, very unequal. Some localities were using all of the available storage capacity.

As stated above, the total storage at refineries was 300,000,000 barrels, 80,000,000 barrels of which was used for crude petroleum. This represents an average of

SUMMARY OF OIL PIPE-LINE MILEAGE AND CAPACITY, BY STATES.

State	1924						May, 1926					
	Trunk lines		Gathering lines		Total		Trunk lines		Gathering lines		Total	
	Miles	Capacity (bbls.)	Miles	Capacity (bbls)	Miles	Capacity (bbls)	Miles	Capacity (bbls)	Miles	Capacity (bbls)	Miles	Capacity (bbls)
Arkansas	591	186,400	645	75,300	1,236	261,700	830	256,100	940	117,500	1,770	373,600
California	3,078	988,900	1,461	207,600	4,539	1,196,500	3,210	1,046,100	1,800	245,700	5,010	1,291,800
Colorado	-	-	29	1,100	29	1,100	8	600	60	4,900	68	5,500
Illinois	1,937	685,400	1,218	141,900	3,155	827,300	1,800	685,800	1,170	139,900	2,970	825,700
Indiana	1,469	514,100	503	29,900	1,972	544,000	1,540	528,500	450	27,900	1,990	556,400
Iowa	77	37,700	-	-	77	37,700	77	37,700	-	-	77	37,700
Kansas	2,542	801,400	2,762	214,300	5,304	1,015,700	2,430	812,700	3,220	250,000	5,650	1,062,700
Kentucky	592	50,100	1,383	48,600	1,975	98,700	570	53,500	1,660	59,800	2,230	113,300
Louisiana	1,751	647,500	806	77,300	2,557	724,800	1,890	690,100	720	70,700	2,610	760,800
Maryland	36	4,700	-	-	36	4,700	33	4,300	-	-	33	4,300
Michigan	138	26,200	-	-	138	26,200	138	25,900	-	-	138	25,900
Missouri	2,485	993,400	-	-	2,485	993,400	2,490	993,100	-	-	2,490	993,100
Montana	93	9,100	20	400	113	9,500	130	9,900	20	400	150	10,300
Nebraska	377	248,700	-	-	377	248,700	404	256,000	-	-	404	256,000
New Jersey	476	116,900	-	-	476	116,900	460	120,200	-	-	460	120,200
New Mexico	-	-	-	-	-	-	70	5,700	20	900	90	6,600
New York	1,192	217,300	687	30,200	1,879	247,500	1,200	218,900	710	26,100	1,910	245,000
Ohio	2,623	768,000	6,192	278,800	8,815	1,046,800	2,690	767,600	6,320	284,200	9,010	1,051,800
Oklahoma	7,695	1,734,400	9,689	673,400	17,384	2,407,800	8,220	1,847,600	10,960	775,900	19,180	2,623,500
Pennsylvania	5,274	1,100.600	6,094	201,300	11,368	1,301,900	5,260	1,065,000	6,340	210,300	11,600	1,275,300
Tennessee	-	-	5	100	5	100	-	-	30	600	30	600
Texas	7,379	2,136,000	4,665	504,100	12,044	2,640,100	9,470	2,747,900	6,060	660,900	15,530	3,408,800
West Virginia	419	71,100	4,957	313,900	5,376	385,000	400	69,300	5,000	313,200	5,400	382,500
Wyoming	1,273	291,000	219	20,400	1,492	311,400	1,130	295,500	220	15,400	1,350	310,900
	41,497	11,628,900	41,335	2,816,600	82,832	14,447,500	44,470	12,538,000	45,700	3,204,300	90,170	15,742,300

The Crosby Super Relief Valve

Highest Discharge Capacity

The Crosby Super Relief Valve is designed to function properly under the high temperatures now used in oil refining processes, particularly in cracking stills. Coke deposits, accumulating on the working parts of this valve, do not affect its efficiency.

All working parts are of the same metal and are free to expand in the valve body. The Seat or Throat Tube also forms an inlet connection. The threads holding this part to the valve body are not required to form a pressure-tight joint, and are not made up very tightly. The throat is free to expand, without distortion, independent of the body.

In the Crosby Super Relief Valve, there are only two parts subjected to the pressure of the still; namely, the throat and the disc. The material used for these two parts is the best suited to withstand the action of still vapors. The hot vapor does not come in contact with any other parts of the valve. For further information regarding the Crosby Super Relief Valve address

Crosby Steam Gage & Valve Co.

Manufacturers of high grade indicating and recording gauges and pop, safety, and relief valves

New York BOSTON Chicago San Francisco

or

Westcott & Greis, Inc.

Distributors in Oklahoma, Texas, Louisiana, Arkansas, and the Southern portion of California

Dallas TULSA Los Angeles

CROSBY SUPER RELIEF VALVES

Quotation from The Oil and Gas Journal (article by Mr. C. O. Willson), page 21, issue of December 23, 1926.

"As previously stated the coming year will unquestionably witness a further large expansion in cracking equipment. With rare exceptions refiners find that they now produce cracked gasoline cheaper than the so-called straightrun product. Many have stated that if it had not been for their cracking units they would not have been able to operate profitably and sold

gasoline at the market which has prevailed this year. Instances can be cited where the straightrun gasoline cost more than the prevailing market. *In these cases the refiners had to rely on their cracking units to manufacture gasoline at a cost low enough to offset the losses in the skimming operation."*

(*Italics used are ours*)

Universal Oil Products Company
Owner of the Dubbs Process
310 South Michigan Ave
Chicago, Illinois

CAPACITY OF STORAGE FOR CRUDE PETROLEUM AND REFINED PRODUCTS IN UNITED STATES, MAY, 1926
(Thousands of barrels)

State	At refineries										Tank farm storage for crude petroleum					Grand Total
	For crude petroleum					For refined products 1/										
	Steel	Wooden	Earthen	Concrete	Total	Steel	Wooden	Earthen	Concrete	Total	Total	Steel	Wooden	Earthen	Concrete	Total	
Arizona	3	-	-	-	3	12	-	-	-	12	15	-	-	-	-	-	15
Arkansas	675	-	20	-	695	1,178	-	-	-	1,178	1,873	11,123	229	28,752	-	40,104	41,977
California	10,884	6	-	11,231	22,121	34,142	1	11	35,446	69,600	91,721	49,576	2	29,791	24,735	104,104	195,825
Colorado	120	-	-	-	120	341	-	-	-	341	461	41	-	-	-	41	502
Georgia	224	-	-	-	224	285	-	-	-	285	509	-	-	-	-	-	509
Illinois	1,681	-	-	-	1,681	7,264	-	-	-	7,264	8,945	13,620	4	-	-	13,624	22,569
Indiana	898	-	-	-	898	10,974	-	-	-	10,974	11,872	1,557	3	-	-	1,560	13,432
Iowa & Nebr.	33	-	-	-	33	42	-	-	-	42	75	621	-	-	-	621	696
Kansas	2,612	55	-	-	2,667	5,889	110	-	-	5,999	8,666	20,993	25	-	-	21,018	29,684
Kentucky	831	-	-	-	831	738	-	-	-	738	1,569	1,090	45	-	21	1,156	2,725
Louisiana	9,608	6	180	-	9,794	17,850	-	-	71	17,921	27,715	15,678	2,145	1,344	-	19,167	46,882
Maryland	1,572	-	-	-	1,572	2,039	-	-	-	2,039	3,611	-	-	-	-	-	3,611
Massachusetts	740	-	-	646	1,386	1,517	-	-	313	1,830	3,216	-	-	-	-	-	3,216
Missouri	180	-	-	-	180	2,048	-	-	-	2,048	2,228	1,558	-	-	-	1,558	3,786
Montana	102	-	-	-	102	273	-	-	-	273	375	1,469	-	-	-	1,469	1,844
New Jersey	7,668	-	-	-	7,668	23,700	-	-	-	23,700	31,368	1,835	-	-	-	1,835	33,203
New Mexico	27	-	-	-	27	86	-	-	-	86	113	344	-	-	-	344	457
New York	2,216	-	-	-	2,216	3,171	-	-	-	3,171	5,387	3,677	5	-	-	3,682	9,069
Ohio	1,068	-	-	-	1,068	3,084	14	-	-	3,098	4,166	14,353	61	-	-	14,414	18,580
Oklahoma	6,061	3	-	30	6,094	16,664	-	-	25	16,689	22,783	117,573	45	-	-	117,618	140,401
Pennsylvania	3,318	32	-	-	3,350	10,379	-	-	4	10,383	13,733	9,304	121	-	-	9,425	23,158
Rhode Island	1,036	-	-	-	1,036	2,195	-	-	-	2,195	3,231	-	-	-	-	-	3,231
South Carolina	651	-	-	-	651	806	-	-	-	806	1,457	-	-	-	-	-	1,457
Tennessee	2	-	-	-	2	150	-	-	-	150	152	1	-	-	-	1	153
Texas	15,687	118	1,060	1	16,866	44,013	96	1,913	3	46,025	62,891	88,443	285	17,427	-	106,155	169,046
Utah	336	-	-	-	336	586	-	-	-	586	922	-	-	-	-	-	922
Virginia	131	-	-	-	131	144	-	-	-	144	275	-	-	-	-	-	275
Washington	30	-	-	-	30	40	-	-	-	40	70	-	-	-	-	-	70
West Virginia	122	-	-	-	122	1,122	-	-	-	1,122	1,244	4,190	125	-	-	4,315	5,559
Wyoming	1,776	-	1	135	1,912	10,525	-	1	-	10,526	12,438	30,702	-	-	-	30,702	43,140
	70,292	220	1,261	12,043	83,816	201,257	221	1,925	35,862	239,265	323,081	387,748	3,095	77,314	24,756	492,913	815,994

1/ At refineries only, except in California.

600,000 barrels of all classes of oil for each refinery in the country. Since on May 1, 1926, there were stored at refineries about 50,000,000 barrels of crude and 120,000,000 barrels of refined oils, it follows that the perecentage of storage filled by the former was 60 and by the latter, 55.

Tank Farms

Tank-farm storage comprised by far the major portion of the total capacity for crude petroleum of the country, and also the major portion of the total capacity for all oils. This type of storage includes tanks on farms and along pipe lines but does not include crude storage at refineries or on producing properties. Owing to incomplete information, storage on producing properties, which is estimated as 100,000,000 barrels, is not considered in this survey.

There are four types of storage, namely, steel, wooden, earthen, and concrete. Steel storage is by far the most widely used and comprises 80 per cent of the total. The remainder was about evenly divided between earthen and concrete storage, with wooden storage as almost negligible. In general, evaporation losses are much higher from wooden tanks than from steel tanks, and a few wooden tanks in use today are either relics of past days or have been built for a special purpose. Evaporation losses are of course higher from earthen storage than from any other type, but the ease with which it can be built has resulted in its use in flush fields producing heavy oil. Concrete storage is of fairly recent origin and finds almost exclusive use in California, where the presence of much flush production in 1923 made the immediate construction of large reservoirs imperative. Concrete storage is cheaper to build than steel storage and, when used for heavy oils as in California, has a remarkably low evaporation loss.

California, with nearly 200,000,000 barrels of tankage, is the leading State in point of storage capacity. Texas, with 170,000,000 barrels, is second; and Oklahoma, with 140,000,000 barrels, is third. Each of these states has about the same amount of crude storage; that is, 120,000,000 barrels. As stated above California is the only state to employ concrete tankage to any extent. This State also leads in earthen storage, with Arkansas a close second. None of the other States has over 50,000,000 barrels of total storage.

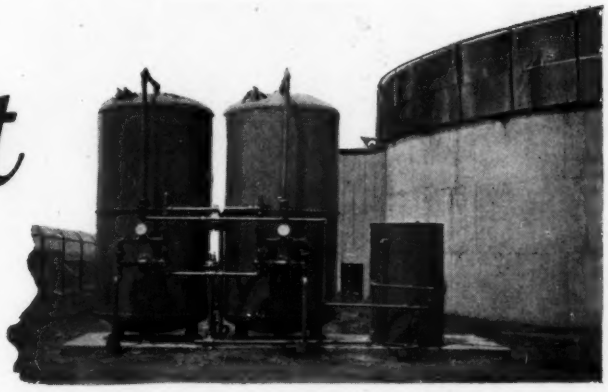
There is available at Atlantic ports approximately 60,000,000 barrels of tankage, 40,000,000 barrels of which is for refined products. At ports on the Gulf of Mexico there is storage capacity of about 130,000,000 barrels, the greater part of which, 75,000,000 barrels, is for crude oil.

CAPACITY OF STORAGE FOR CRUDE PETROLEUM AND REFINED PRODUCTS IN UNITED STATES, MAY, 1926 (CONTINUED)
(Thousands of barrels)

State	Storage for crude petroleum					Storage for refined products 1/					Total				Grand Total
	Steel	Wooden	Earthen	Concrete	Total	Steel	Wooden	Earthen	Concrete	Total	Steel	Wooden	Earthen	Concrete	
Arizona	3	-	-	-	3	12	-	-	-	12	15	-	-	-	15
Arkansas	11,798	229	28,772	-	40,799	1,178	-	-	-	1,178	12,976	229	28,772	-	41,977
California	60,460	8	29,791	35,966	126,225	34,142	1	11	35,446	69,600	94,602	9	29,802	71,412	195,825
Colorado	161	-	-	-	161	341	-	-	-	341	502	-	-	-	502
Georgia	224	-	-	-	224	285	-	-	-	285	509	-	-	-	509
Illinois	15,301	4	-	-	15,305	7,264	-	-	-	7,264	22,565	4	-	-	22,569
Indiana	2,455	3	-	-	2,458	10,974	-	-	-	10,974	13,429	3	-	-	13,432
Iowa Nebraska	654	-	-	-	654	42	-	-	-	42	696	-	-	-	696
Kansas	23,605	80	-	-	23,685	5,889	110	-	-	5,999	29,494	190	-	-	29,684
Kentucky	1,921	45	-	21	1,987	738	-	-	-	738	2,659	45	-	21	2,725
Louisiana	25,286	2,151	1,524	-	28,961	17,850	-	-	71	17,921	43,136	2,151	1,524	71	46,882
Maryland	1,572	-	-	-	1,572	2,039	-	-	-	2,039	3,611	-	-	-	3,611
Massachusetts	740	-	-	646	1,386	1,517	-	-	313	1,830	2,257	-	-	959	3,216
Missouri	1,738	-	-	-	1,738	2,048	-	-	-	2,048	3,786	-	-	-	3,786
Montana	1,571	-	-	-	1,571	273	-	-	-	273	1,844	-	-	-	1,844
New Jersey	9,503	-	-	-	9,503	23,700	-	-	-	23,700	33,203	-	-	-	33,203
New Mexico	371	-	-	-	371	86	-	-	-	86	457	-	-	-	457
New York	5,893	5	-	-	5,898	3,171	-	-	-	3,171	9,064	5	-	-	9,069
Ohio	15,421	61	-	-	15,482	3,084	14	-	-	3,098	18,505	75	-	-	18,580
Oklahoma	123,634	48	-	30	123,712	16,664	-	-	25	16,689	140,298	48	-	55	140,401
Pennsylvania	12,622	153	-	-	12,775	10,379	-	-	4	10,383	23,001	153	-	4	23,158
Rhode Island	1,036	-	-	-	1,036	2,195	-	-	-	2,195	3,231	-	-	-	3,231
South Carolina	651	-	-	-	651	806	-	-	-	806	1,457	-	-	-	1,457
Tennessee	3	-	-	-	3	150	-	-	-	150	153	-	-	-	153
Texas	104,130	403	18,487	1	123,021	44,013	96	1,913	3	46,025	148,143	499	20,400	4	169,046
Utah	336	-	-	-	336	586	-	-	-	586	922	-	-	-	922
Virginia	131	-	-	-	131	144	-	-	-	144	275	-	-	-	275
Washington	30	-	-	-	30	40	-	-	-	40	70	-	-	-	70
West Virginia	4,312	125	-	-	4,437	1,122	-	-	-	1,122	5,434	125	-	-	5,559
Wyoming	32,478	-	1	135	32,614	10,525	-	1	-	10,526	43,003	-	2	135	43,140
	458,040	3,315	78,575	36,799	576,729	201,257	221	1,925	35,862	239,265	659,297	3,536	80,500	72,661	815,994

1/ At refineries only, except in California.

Prevent
That Costly Film of Scale



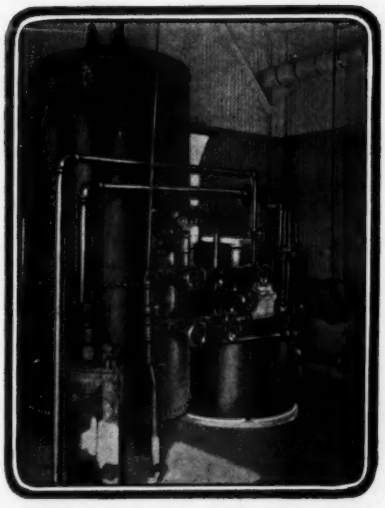
COOLING COILS function well only if metal surfaces are clean.

Let even a thin film of scale deposit from the water and cooling efficiency drops off in short order. It takes only an eighth of an inch of scale to insulate the tubes, cut into production and impair economy.

Eliminate the cause of this film and the trouble disappears. Softening the hard water will do it. Paige & Jones engineers know water softening from all angles. There are several of these engineers in the oil districts working with refinery engineers on cooling water and other hard water problems.

Ask about Paige & Jones zeolite softeners now in use in the refineries. Possibly the problems encountered in these plants are the same as in yours.

If so, the remedy will be the same—a Paige-Jones zeolite softener.



Other uses for Paige-Jones softening equipment in the oil fields

Softening water for cooling coils
Softening water for cooling jackets
Softening water for boiler feed water

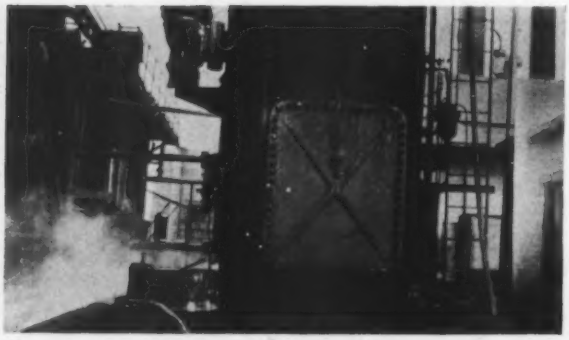
Page & Jones can handle any of these problems.

PAIGE-JONES CHEMICAL CO., Inc.

General Sales Office: Technical Dept. & Works HAMMOND, INDIANA
Executive Offices 461 FOURTH AVE., NEW YORK
Offices in Principal Cities

PAIGE-JONES WATER SOFTENING

ZEOLITE AND LIME SODA SOFTENERS · PRESSURE SAND FILTERS
BOILER FEED WATER TREATMENTS · HOUSEHOLD WATER SOFTENERS



Close-up of reboiler on Gardner Tower

Compressor Station

Tower Affects Saving in Gasoline Recovery

By A. R. McTEE
Staff Representative

LAST spring when the Simms Oil Company took over the Dallas refinery of the Clayton Oil and Refining Company, several problems presented themselves for solution before the plant could be operated on an efficient basis. Considerable remodeling was done and the refinery started running, but no sooner had crude entered the stills than three specific needs showed up.

These were: An absorption plant to recover gasoline in the tank vapors, in the tail-house, and gases from the cracking plant; some method of drying out the gas oil stream; and some system of fractionating the 500 end-point naphtha.

Of course the second and third difficulties could have been met by a re-running installation, but this would have cost somewhere in the neighborhood of $50,000. An absorption plant would still have been necessary.

By means of a special tower, called the Gardner Tower, after Frank Gardner, chief engineer for Simms, who designed it, all three of the problems were taken care of, at a very slight fraction of the cost of a re-run installation, and with equal if not more satisfactory results.

As the crude goes through the nine shell stills, it yields about 39 per cent gasoline, four per cent kerosene, four per cent 500 end-point naphtha, a small amount of gas oil, and a 22 gravity fuel oil.

This fuel oil goes through a heat exchanger to exchange heat with incoming crude and then enters a Foster type tube still, at a temperature of 295 degrees F. This temperature is raised to 850 degrees in the tube still, at between 25 and 50 pounds pressure. The oil then goes to the evaporator where the gas oil and fuel is separated, the resulting fuel oil being of about 14½ gravity. In the tube still there is a slight cracking that lowers the viscosity of the fuel oil and also produces a small amount of gasoline that is left in the gas oil.

This gas oil goes into the Gardner Tower which supplies sufficient heat together with the fuel oil going through the re-boiler to fractionate the gasoline in the gas oil and also the absorption gasoline that comes to the tower from the absorbers.

There are four Cross type cracking units with bubble towers. Non-condensible gas from these towers is run through two absorption towers. The 500 end-point naphtha from the shell stills is used as an absorption media in these absorbers. This with the gasoline absorbed from the cracking plant gas is run to the Gardner tower without applying additional heat, and a total of between four and five per cent of gasoline, based on the crude oil throughput, is obtained in this way. The end-point is controlled by an automatic temperature control on the tower.

The tower works on a different principle from bubble towers in that the liquid is broken up instead of the vapors.

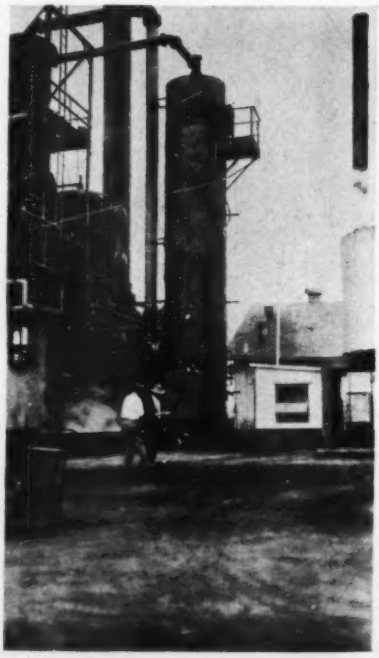
The tower is equipped with temperature control, liquid level regulators, and a reboiler which utilizes fuel from the pipe still evaporator, in case additional heat is needed in the tower.

A compressor takes the gas off light oil tanks and about two per cent of gasoline is condensed from this gas.

The plant is now running about 4500 barrels of North Texas crude, daily, and is getting a gasoline recovery of about 60 per cent.

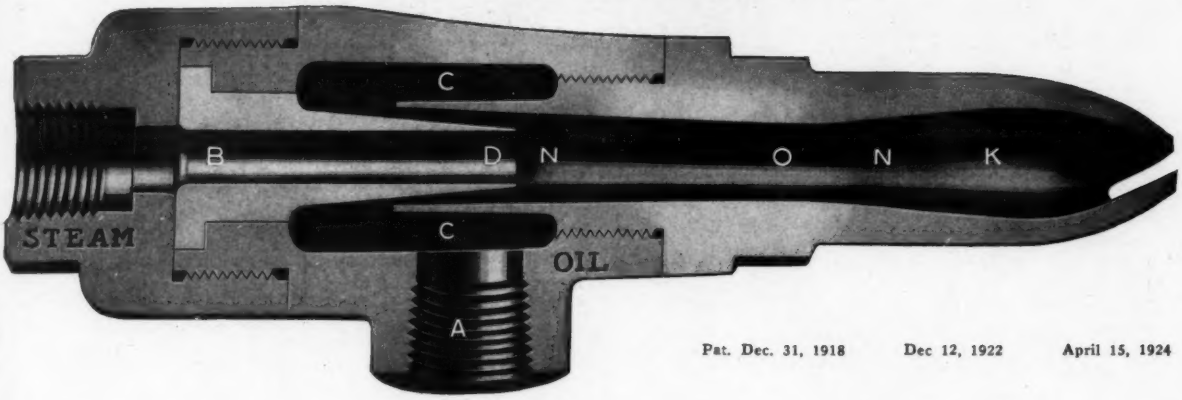
The Gardner Tower makes possible a saving of at least 10 per cent in the gasoline recovery, with only the expense necessary to insall the two absorbers and the tower.

Absorption towers that work in conjunction with the specially designed Gardner tower.



Gardner Tower

NATIONAL AIROIL BURNERS



Pat. Dec. 31, 1918 Dec 12, 1922 April 15, 1924

OVER ONE HALF OF ALL THE REFINERIES IN THE COUNTRY ARE NOW USING OUR STEAM ATOMIZING OIL BURNERS

ALL BUT ONE OF THE WELL-KNOWN CRACKING PROCESSES ARE STANDARDIZED ON OUR EQUIPMENT

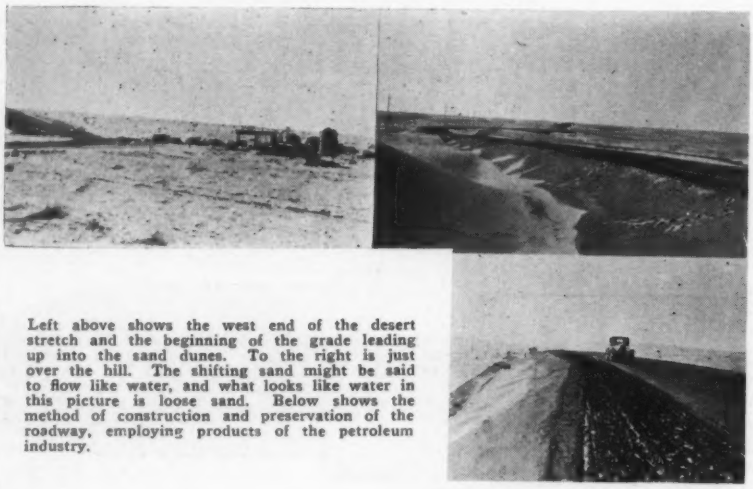
The largest refineries in the world have rated our Oil Burners highest in efficiency tests, and simplest, most accurate and most reliable in operation.

We would like to send you our Bulletin No. 21, describing and illustrating our Burners and Control Valves, together with our special prices to petroleum refineries.

NATIONAL AIROIL BURNER COMPANY

NINTH AND THOMPSON STREETS

PHILADELPHIA



Left above shows the west end of the desert stretch and the beginning of the grade leading up into the sand dunes. To the right is just over the hill. The shifting sand might be said to flow like water, and what looks like water in this picture is loose sand. Below shows the method of construction and preservation of the roadway, employing products of the petroleum industry.

Oil Soaked Sand Dunes Support Asphalt Road On Southern California Route

By GEORGE REID
Staff Representative

THE Southernmost gateway to Southern California is now permanently opened. A few miles across the California-Arizona state line and just out of Yuma, Arizona a few miles, lies a waste of shifting sand, piled high in dunes of every changing size and shape; almost as variable in their conformity as the rolling waves on the high sea, and the petroleum industry has contributed most importantly to the conquering of this seven mile stretch of ever shifting, constantly moving desert. A permanent roadway, a speedway de luxe, is now provided for the heavy traffic over the year-round route from coast to coast, and oil is its main factor of construction as well as its preservation.

Where days were once consumed in going round this desert, and then many hours required in the later sandy road way; and where some hours were required to cross the tortuous single track plank road recently eliminated—now the motorist speeds across the sand hills in a matter of minutes—but giving thanks to asphalt and light road oils.

The old plank road was built in sections, and when the shifting sands moved quietly over the roadway, men went out and moved the roadway over, or again on top of the sand.

Engineers went out and built a seven mile winding sand dune of their own—stretching entirely across the desert, which they packed down tightly with oil and water. The man made and man controlled sand hill at places is 15 to 20 feet in height and at its top a width of about 30 feet is provided. It appears as an ancient Chinese wall entirely built of sand.

Across the top of this packed sand dune the engineers laid asphalt-concrete pavement wide enough for trucks and cars to pass with ease at any speed. The accompanying photographs of the road bed and the sand dune country surrounding the highway show the problem which oil and asphalt has been called upon to solve.

After the construction of the excellent road bed was completed it was found that the great piles of sand which stretch for miles on either side of the asphalt road were still to be contended with in their movement. No doubt, in time the desert would, if let alone, completely cover the roadway, reclaiming it as part of the great waste of sand. The blowing, moving sand is therefore removed from the highway by road sweepers when necessary, and after each sweeping of the asphalt bed, the supporting tightly packed embankment is sprinkled with light road oil and thus sand blown toward the road becomes part and parcel of the oiled highway. In addition to this factor, the oil sprinkled embankment or seven mile mound is rendered dustless and clean. On the present asphalt and oil roadway the motorist and the freight truck move smoothly and speedily across the "sandiest and dustiest" spot on earth without dust.

From the asphalt and road oil of the oil industry, and from the very source of the worst road troubles, the desert sand, man has made an excellent roadway for his convenience.

C. F. Braun is Building Larger Factory

C. F. Braun and Company, Alhambra, California, manufactuirng mechanical engineers have just completed another addition to their factory. A consistent increase in business necessitated occupying the extension some time before it was completed.

This expansian is the fourth extension of the facilities of this organization since the company started its present plant less than four years ago. In that time the iron and brass foundries have been almost tripled, while the machine shops and assembly rooms have been approximately doubled in size and capacity.

New property has been recently acquired on which the company is constructing one of the largest and most modern steel foundries in the west.

G. Elmo Fullmer, formerly testing engineer in the southern division of the Standard Gasoline Company, of California, has been made district supervisor in charge of Brea, Montebello, Santa Fe Springs, Murphy-Coyote and Kraemer plants. Mr. Holbrook will continue as district supervisor of plants in the Huntington Beach and Seal Beach district and Mr. Frey will be in charge of plants in Long Beach, Torrance, Dominguez, Athens and Inglewood.

Cooling Tower Bulletin

Atmospheric cooling towers constitute the subject of a bulletin published a short time ago by The Cooling Tower Company, Inc., 15 John Street, New York. This bulletin completely covers the subject and gives much scientific data on results achieved with various types of towers. Copies can be had from the company on request.

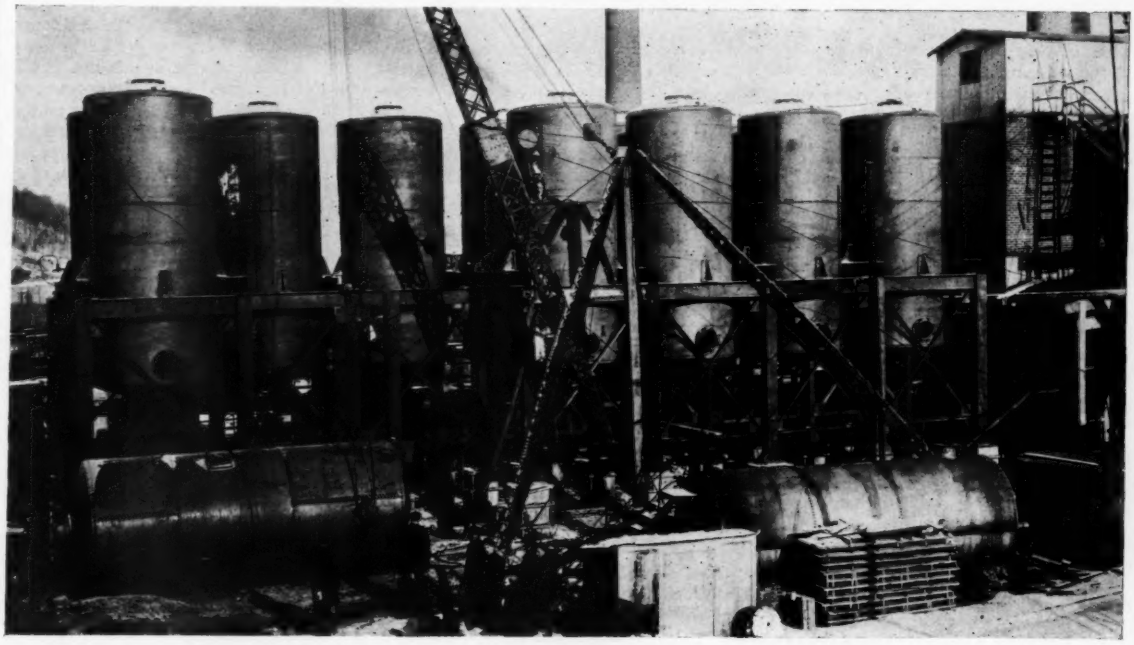
New Quigley Agent in Atlanta

Atlanta, Georgia—Quigley Furnace Specialties Company, 26 Cortlandt Street, New York City, announces the addition of George A. Russ to their service staff. His district will include the Central South and Atlantic states.

Mr. Russ has been for years identified with manufacturing and sales departsments of large industrials in the territory he now covers for Quigley and he enjoys a wide personal acquaintance throughout the field.

His headquarters will be in Atlanta, Georgia.

John E. Jones, superintendent of gasoline plants for the Marland Refining Company in the Texas division with headquarters at Fort Worth, has been transferred to Ponca City, Oklahoma, and made manager of the natural gasoline manufacturing department for Marland throughout the Mid-Continent. H. T. Owen has succeeded Mr. Jones as manager of the Texas division, and has offices on the second floor of the W. T. Waggoner building, Fort Worth.



Installation of a battery of Hammond Filters at the Plant of the **Pennzoil Refinery at Oil City, Pa.,** makers of **Quaker State** and high grade lubricating oils of national reputation. **The Hammond Filter** with the Fulton Patented Head is a labor saver, doing away with old fashion methods and is now being used by many of the **leading refiners.** They are made in a variety of sizes. Diameters from 5 ft. to 10 ft. and in heights of 10 ft. to 30 ft. Send for our Bulletin No. 300. May we have an opportunity of quoting on your requirements?

HAMMOND IRON WORKS

WARREN, PA.

Manufacturers and Exporters of Steel Tanks and Steel Plate Construction

New York Office: 17 Battery Place—Telephone Whitehall 0060)

Corrosion in Natural Gasoline Manufacture

(*Continued from page 56*)

tigation of the use of potassium dichromate was begun, in which the earlier tests were repeated on a broader scale, and a satisfactory method of plan control was worked out.

The initial step in applying the results of these tests in plant practice consisted in using condensed water as much as possible in all the systems and maintaining the dichromate strength as nearly as possible at two pounds per 1,000 gallons. This system, modified somewhat as noted below, was installed in all the extraction plants in the spring of 1925, and since then corrosion has been eliminated.

Later experiments proved that sodium chromate although it contains 52.5 per cent of water of crystallization, is as effective, pound for pound, as potassium dichromate. Sodium chromate has been substituted for dichromate in all the plants, since it is cheaper, and one noted authority states that it is to be preferred to dichromate as an inhibitor of corrosion.

Every two weeks a sample of water from each plant is brought to the laboratory where it is tested and a report is delivered to the production foreman who, knowing the volume of water in circulation at each plant, issues orders as to the amount of chromate to be added as makeup. The chromate strengah usually falls considerably below normal toward the end of the two-weeks period but no ill effects have been noted to date. At the present time consideration is being given to the possibility of extending the time between periods of normal strength to one month. Such a change would of course, necessitate careful watching during the initial period.

The method of testing these samples in the laboratory may be of interest. A solution of chromate of a strength of 1 pound per 1000 gallons (0.1198 gm. per l. of solution) is prepared and kept in a stoppered bottle. An approximately N/10 solution of sodium thiosulphate is prepared and standardized for this purpose by titrating to the disappearance of the blue color of 100 cc. of the chromate solution, to which about 1 gram of potassium iodide and 10 cc. of strong hydrochloric acid and a few drops of starch solution have been added. In making a regular test 100 cc. of each sample is titrated and the chromate strength obtained by dividing the cc. of thiosulfate consumed in the test by the cc. required for titrating 100 cc. of the one-pound solution.

Scale Removed

At times the available condensed water is insufficient for makeup, and hard water is turned into some of the systems. Immediately scale begins to form but no corrosion occurs. Usually in a comparatively short time condensed water is again available and is turned in. This slowly dissolves the scale deposited during the use of hard water, and, in such cases the calcium and magnesium content of the water remains high for a considerable time. In one notable case, where very hard water was used for several months and the scale built up in the jackets to such thickness that it interfered seriously with the heat transfer, it required a number of month, in which a considerable volume was regularly wasted and replaced with condensed water, before the calcium and magnesium content of the circulating water fell to normal, indicating that the scale had all been removed. During this period the consumption of chromate was high, as each addition of condensed water called for more chromate. At no time, however, was any trouble experienced with corrosion.

As is often the case in such work unexpected information was obtained. For example, at one plant where the amount of chromate required for makeup was much greater than at any other plant, inquiry revealed that an inordinate amount of makeup water was being used. The natural explanation was that there was a serious leak in some of the underground piping. Extended search revealed such a leak, and after it was repaired the consumption dropped to normal.

Adding Chromate

The method of adding the chromate to the circulating system varies at the different plants. The point of addition is of no consequence so long as complete solution of the chromate in the circulating water is assured. Under normal conditions the amount of chromate needed per month as makeup is about 100 pounds at a plant operating three 970-horse power Coopers.

At the present time chromate water is being used at only one of the 20 booster stations, but plans are being made for extending its use to all the stations.

Chromate is now being added to the water which is being sprayed over coils in several of the towers, to protect, if possible, the coils from further external corrosion. When the chromate was first added the consumption was very high, but it has gradually decreased to a fraction of the initial amount. This was, no doubt, due to oxidation of ferrous iron in the scale and organic matter, such as moss, in the basins. It is still too early to say how much the life of old coils can be extended by this treatment, but if new coils were sprayed with chromated water it seems fair to assume that the formation of the ordinary thick, spongy rust would be greatly retarded if not prevented altogether.

Since this paper is intended primarily as a chronicle of observations of tests, no statement of the theories involved will be given. There are now available several excellent books and innumerable articles in which the theories of corrosion are covered in great detail. All the books and many of the articles mention the inhibiting effect of dichromates on corrosion. This inhibiting effect has been known for at least 20 years. F. N. Speller, in his recent book[1] recommends the use of such inhibitors in circulating water systems, but no example of such use has come to our attention.

Of all the factors which are conceded to exert an influence on corrosion the following are believed to be those of most importance in under-water corrosion in case of neutral or slightly alkaline water and in the absence of any agent tending to prevent corrosion: (1) Temperature; (2) oxygen concentration; (3) agitation; (4) mechanical strains in the iron, and (5) the presence in contact with the iron of metals or alloys electrically negative to iron. Broadly speaking, an increase in any of these items tends to increase corrosion. Thus, in case of water-cooled Cooper piston rods, the conditions for rapid corrosion are as nearly ideal as it is possible to imagine.

The action by which inhibitors, or passivifiers, as they are sometimes called, retard or prevent corrosion is not well understood. That some change takes place at the surface of the metal is proven beyond question but the nature of this change can not be observed even under microscopic examination. A specimen which has been immersed for some time in a strong solution of chromate remains passive to corrosion for a considerable time after being removed from the solution. This tendency evidently explains why no corrosion occurs between periods of normal strength of solution in the circulating system.

All steam from the boiler plants operated in connection with the gasoline extraction plants is condensed, and the condensate returned to the boilers, the makeup being secured from evaporators. The evaporators are also used to produce the condensed water used as makeup in the plant circulating water system. The corrosive effect of condensed water in the boilers is overcome by the use of deaerators, of which there are several well-known makes on the market.

[1] F. N. Speller: Corrosion—Causes and Prevention. 1st ed. (1926) 354.

Hills - McCanna Issues Specialty Catalog

Hills-McCanna Company, 2025 Elston Avenue, Chicago, have recently published a new catalog covering their power plant equipment.

In addition to the usual line of steam specialties, the catalog describes a line of chemical proportioning pumps designed for the metering of boiler compounds, water softening chemicals and various commercial chemicals entering into the manufacturing process in the chemical and oil industries.

The subject of lubrication is dealt with in length and the various types of force feed lubrcators made by this company ar eall described in the catalog.

Copies will be sent on request to the company.

L. M. Bounds, the former superintendent at Okmulgee, has been transferred to the Empire Company's refinery, located at Boston, Massachusetts.

The LIENTZ RECIRCULATING SYSTEM *Provides*

MILD EVEN TEMPERATURES
LARGE VOLUME COMBUSTION GAS
INCREASED THRUPUT AND YIELD
REDUCED MAINTENANCE COST
AND A SUBSTANTIAL SAVING IN FUEL!

REFINERS throughout the country who are now operating the Lientz Recirculating System well realize the important advantages gained and the substantial economies this system effects. They expected marked results before installation—and were highly pleased to see the ease with which they were attained. These advantages should appeal to you, too. We will be glad to explain the Lientz Recirculating System to you fully, adapting it to your present equipment. We will do this without obligation.

CATALOG TELLS ALL

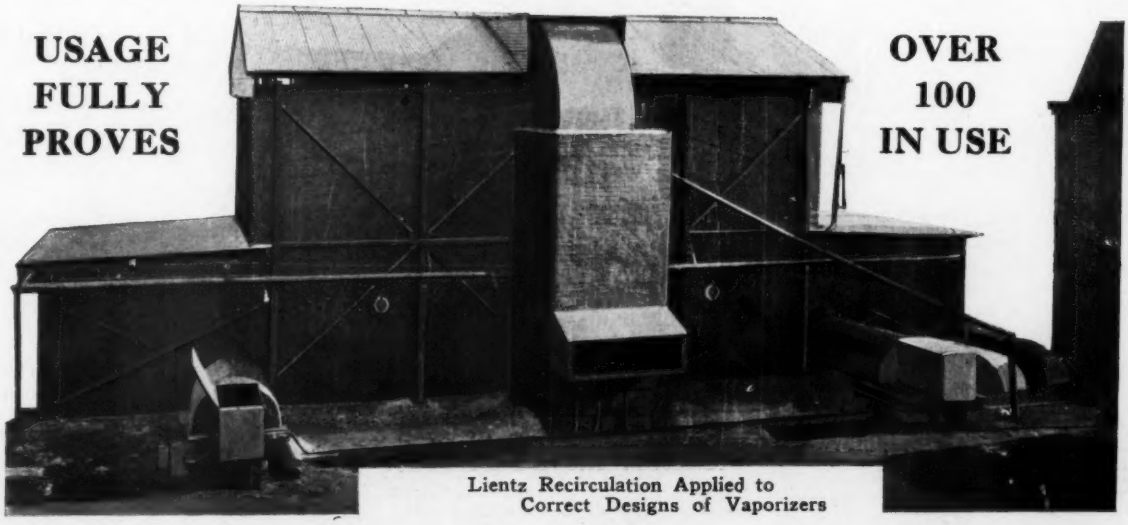
B. P. LIENTZ & COMPANY

Kansas City, Mo.

LOS ANGELES FT. WORTH NEW YORK

USAGE FULLY PROVES

OVER 100 IN USE



Lientz Recirculation Applied to Correct Designs of Vaporizers

Bessemer gang assembled for their annual sales convention at the Penn Grove Hotel, Grove City, Pennsylvania

New Folder on Texas Fire Brick

Evens and Howard Fire Brick Company, St. Louis, Missouri, have announced a folder describing two new brands of fire brick being made at the company plant, Malakoff, Texas.

The Durofrax brand brick is manufactured from selected clays of great plasticity, and is made by the stiff mud process, resulting, according to the manufacturers, in a strong, dense brick suitable to withstand great abrasive action, rough usage, and high temperatures.

The Texafrax brand is manufactured from especially selected, highly refractory clays. It is made by the dry press process, resulting in a brick very uniform in size with straight edges and and surfaces, enabling it to be laid to a tight brick-to-brick joint as required in modern furnace construction.

Copies of the bulletin will be sent upon application to the company.

B. F. Bart, until recently district sales manager of the A. O. Smith Corporation with offices in Los Angeles, has been transferred to the home office at Milwaukee, Wisconsin, and made assistant sales manager of the oil field division.

Mr. Bart has a wide acquaintance in the oil industry. After a metallurgical engineering course at Penn State University, he was successively employed in various departments of the National Tube Company; served at Washington under James C. Bonner, vice-president, in charge of steel distribution of the American Iron and Steel Institute and for the five and a half years immediately preceding his connection with the A. O. Smith Corporation, Mr. Bart was New York district sales manager of the Standard Seamless Tube Company.

The Los Angeles office of the A. O. Smith Corporation is now under the supervision of Edward A. Livingstone.

Gene Metz Has Sold Meters 35 Years

Kansas City—Thirty-five years isn't so long, but it is time enough to see many developments in the gas meter industry, according to Gene Metz, who has just completed his thirty-fifth year with the Metric Metal Works and the American Meter Company.

His territory has included the Middle-west and the Southwest, and his headquarters have been in Kansas City.

Mr. Metz is a member of the American Gas Association, the Middle-West Gas Association, the Southwestern Utilities Association, and was an early member of the Natural Gas Association.

Gene Metz, who has just completed his 35th year in meter sales work.

Elliott Company Buys Ridgway Concern

Jeanette, Pa. — Elliott Company, which has recently acquired the Ridgway Dynamo & Engine Company, announces the consolidation of the district sales and service offices of the two companies, the Ridgway men joining forces with the Elliott personnel. In some cases the former Elliott offices have been retained in the old location. In other cases new and larger quarters have been found necessary. This joining of forces strengthens the capacity of the combined organizations to serve customers and prospective customers in a broader and more constructive fashion.

Marley Superheaters Described

Power engineers will be interested in a new publication devoted to Marley steam superheaters for horizontal and return tubular boilers.

The Marley superheater can be adapted to small steam plants, thereby enabling operators to obtain the same efficiency that is common in large installations.

Full particulars are given in the catalog and there are sufficient illustrations to show the superheaters in detail.

Copies may be obtained upon application to the Power Plant Equipment Company, Inc., Kansas City, Missouri.

Smithsteel Couplings Catalog

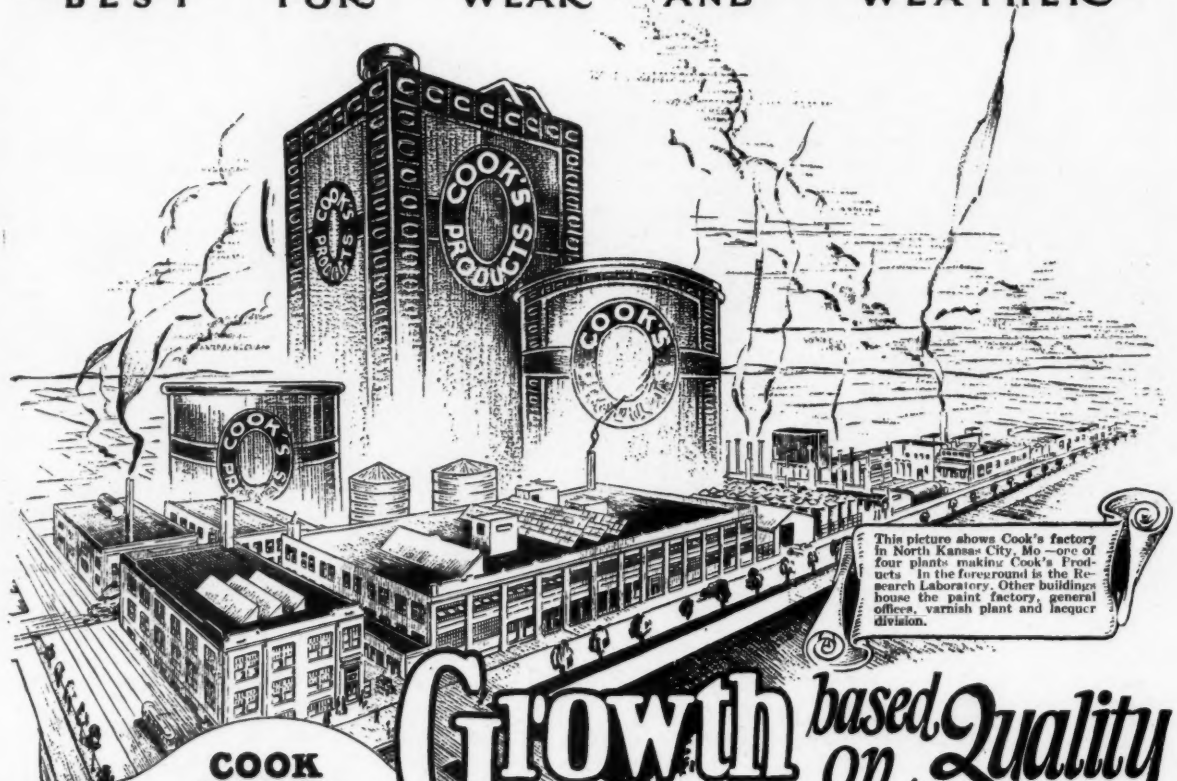
Smithsteel Couplings are described in Catalog No. 114 released from the press a short time ago by the A. O. Smith Corporation, Coupling Division, Milwaukee, Wisconsin.

Manufacturing processes involved in turning out these products are completely discussed in the booklet and illustrated with interesting pictures taken in the company plant.

Copies are obtainable on request.

Don Eells, of late assistant superintendent at the Ponca City refinery of the Empire Company, is now at the Okmulgee refinery of the company, where he is superintendent of the plant.

"BEST FOR WEAR AND WEATHER"



This picture shows Cook's factory in North Kansas City, Mo.—one of four plants making Cook's Products. In the foreground is the Research Laboratory. Other buildings house the paint factory, general offices, varnish plant and lacquer division.

Growth based on Quality

HERE is a fourteen-year-old paint company that has become a leader in oil industry sales because it had the vision to *specialize* and the good sense to build on *quality* foundations!

Specialized paints are particularly needed in the oil industry, in order to preserve steel refinery equipment, storage tanks, tank cars, tank wagons, etc.

The Physical and Chemical Laboratories of the Cook Paint & Varnish Company early recognized this problem. We know paint. We have spent a lifetime in the paint business. And being located in the very heart of the mid-continent oil fields, we have naturally specialized in the production of paints for the oil industry.

We successfully developed formulas which make use of rust inhibitive pigments to prevent the corrosion of iron or steel. We have spent time and money to perfect priming and finishing coats that are properly elastic; and which therefore are not subject to surface checking and cracking. We have developed top coats or field coats that are weatherproof, waterproof and fumeproof. And we have perfected a *fresh* aluminum tank paint that prevents excessive evaporation of gasoline and light napthas—thus reducing evaporation losses. We have developed protective paints that are beautiful as well as durable—which have an advertising value, in addition to their protective qualities when applied to tank cars and trucks and filling stations.

As specialists in this field, we have published an informative booklet on *"Paints for the Oil Industry."* It is packed with valuable information for anyone who buys paint; and we are glad to send copies free on request.

COOK PAINT & VARNISH COMPANY
Dept. 1001, Kansas City, Mo.

COOK Factories Are Located at ~

KANSAS CITY
ST. LOUIS
FT. WORTH
HOUSTON

COOK Branches Are Maintained at ~

CHICAGO
WICHITA
OMAHA
TULSA
OKLAHOMA CITY
DENVER
DETROIT
ST. JOSEPH
DALLAS

COOK'S
PAINT AND VARNISH PRODUCTS

Trend of California Absorption Practice

(*Continued from page 49*)

initial boiling point) can be maintained very closely to that of new oil. This has not been the case heretofore, a condition which has retarded the industry as regards the establishment of definite specifications for absorption oil.

The Absorption Oil

The question of "What is a good absorption oil?" while frequently asked, still meets with an elusive answer. Although difficult to answer directly, there are certain principles that are becoming established. It is still a matter of opinion, more or less, but when opinion is derived from observation of the trend in a large number of cases over a period of several years it is liable to be a reflection of fact. There has been a steady and gradual change from the high initial—high end type of oil (starting with the light lubricating oil fractions) through gas oil and mineral seal to a light kerosene distillate. It has been a source of annoyance to natural gasoline engineers that while recognizing that the initial boiling point of an oil is a very important property, the rapid loss of the light fractions when the oil is in use has prevented consistent study of this characteristic. As intimated in the preceding paragraph, we may expect some interesting developments to come from the rectification of the gasoline vapors.

The comparatively low price and small consumption of absorption oil has not tended to elicit the heartiest support from the refiners for the production of special oils. While it may be highly desirable to have a narrow cut fraction from a segregated crude oil, the production of such a commodity does not fit into the general refining scheme of the average refinery. Further difficulties also come from the fact that there is no common specification for absorption oil and there is a wide variance of opinion as to what the characteristics should be.

Oil Cooling

The subject of oil cooling has received a great deal of attention in California natural gasoline plants. An early recognition of the importance of the last few degrees approach to wet bulb temperature has had a marked effect upon the design and selection of cooling towers. The average wet bulb in the Southern California fields is about 650 degrees F., the relative humidity being 60 to 80 per cent, these conditions requiring careful selection of cooling equipment if a near approach to wet bulb is to be realized. Since the performance of cooling towers shows a greater variation with respect to the wind velocity than with almost any other variable factor, there is a tendency to let results obtained under conditions not representative of the average, influence the opinion as to the over all performance. Thus it is nothing out of the ordinary to hear of cooling installations in which it is stated that the oil is cooled to within two degrees F. of wet bulb, while it is doubtful if the actual average approach in such cases is nearer than 10 degrees F., taken the year around.

Both closed coolers and open coil systems are in use, each type having its adherents and both performing equally well if properly selected. It is generally conceded that in selecting equipment, the performance of which effects production as vitally as do oil coolers, the installation giving the lowest possible average temperature of the oil, is to be chosen so long as the first cost is within reason. In fact, some engineers are considering the possibility of combining mechanical refrigeration with the present cooling systems for the purpose of getting oil temperatures below the definitely limited cooling tower minimum.

Summary

In conclusion it may be said that the California natural gasoline industry has a tendency to exchange information and standardize practice as far as possible. More than ever before, changes are taking place on the basis of established principles, a friendly and helpful attitude being shown in the working out of the common problems of the industry. While empirical methods are used, the industry as a whole is not content with them, but is continually looking forward to better methods and ways of increasing efficiency. The secret of the advancement made by the California industry has been in the willingness to experiment and to exchange ideas.

California Absorption Plant Takes Small Space.

(Continued from page 51)

trol causes the continuous removal of the water as it accumulates in the tank, and the pure water is delivered in a constant small stream back up to the top of the cooling tower, flowing into the open box in which is partially submerged, the partial condenser. This is accomplished by reason of the fact that the entire system of partial condenser coils, mist extractor and de-watering tank is under the operating pressure of the absorption system.

Removal of Reflux Material

The second interesting feature of this system is the removal of the accumulated reflux material and its utilization. When the mixture of water and reflux material separates in the de-watering tank, the lighter reflux material naturally accumulates at the highest level. The float control device regulates the level of the water in the tank, and the static head is sufficient to cause the removal of the reflux material from the de-watering tank. This reflux material flows from the tank into the top of the nearby stripper where it is employed as a cooling medium and reflux wash in the three uppermost trays in the stripper. The reflux material under present operating conditions has about the following specifications: Gravity, about 55 degrees A. P. I., and upon distillation yields around 90 per cent of 400 E. P. gasoline. Thus, it is an almost ideal reflux medium.

The installation of this system is an interesting development and improvement over former practice, and in its smooth, uninterrupted and definitely controlled operation might be termed almost uncanny. The system of extraction, dewatering and control is patented by the designing engineering company.

At the time of the writer's visit, the plant had been in operation only three or four weeks, and definite efficiency figures were not yet available, but company engineers were prompt in expressing their satisfaction with the plant's performance. From the viewpoint of the daily production of 17,000 gallons of gasoline through the small installation there can be little doubt of agreeable efficiency. The design and layout of this small plant of such large capacity is also of striking interest.

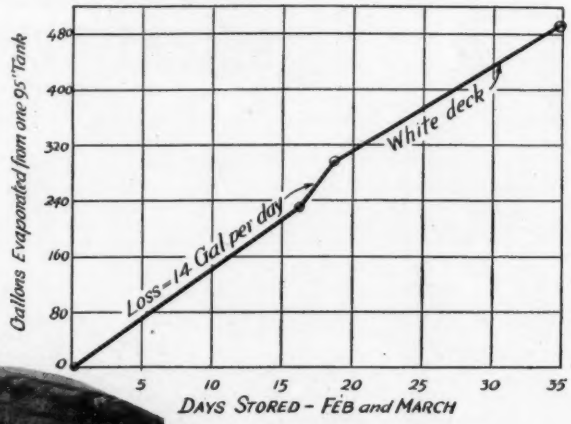
Flow Meter Instruction Book

Following the recent introduction of the new electric flow meter manufactured by The Brown Instrument Company, Philadelphia, Pa., that company has prepared a special instruction book for the benefit of the users of the new flow meter. Operating as it does on the novel inductance bridge principle, with its great advantages of simplification, installation of The Brown Electric Flow Meter is relatively simple. The instruction book comprises 25 pages of easily understandable directions and diagrams. By careful planning, however, it has been made to cover concisely, yet clearly, all ordinary installation conditions and requirements. For unusual circumstances, The Brown Instrument Company's engineering service can be called upon for assistance.

Much of the information in this book is of general interest to present and prospective users and specifiers of all makes of flow meter equipment. Copies will be sent to all responsible persons on request, addressed directly to The Brown Instrument Company, Philadelphia.

H. E. Snyder has been appointed manager of the natural gasoline department of the Magnolia Petroleum Company in the Texas division with headquarters at Olden. Mr. Snyder succeeded W. M. "Bill" Ray, who was placed at the head of the natural gasoline plant activities of the Magnolia in the entire Mid-Continent district several months ago.

Wiggins Roofs being installed on 36-foot working tanks at a refinery.



This chart illustrates a test made by the engineers of a large oil company to determine the loss from standing storage equipped with Wiggins Roofs.

Minimizing Evaporation from standing storage

HOW much do you lose by evaporation from your standing storage? Compare your figure with the 14 gallons per day for a 95-foot tank reported by one large oil company as shown in the chart above.

Wiggins Roofs made this low record possible. Although the test was made during February and March, the location was in the extreme south and temperatures were high. The blend of crude oil and natural gasoline used had a "vapor pressure" about twice that of motor gasoline.

At the rate shown above, the annual loss from a 95-foot tank equipped with a Wiggins Roof would be only 122 barrels. Based on relative vapor pressures, the annual loss of motor gasoline under the same conditions would be only 81 barrels.

Wiggins Roofs are protecting both storage and working tanks at many leading refineries. They are daily demonstrating their reliability in operation and tremendous savings effected. Under most conditions they pay for themselves in a few months.

Ask for details of other records with Wiggins Roofs and let us give you estimates for equipping your tanks, old or new.

Chicago Bridge & Iron Works

Chicago, 2463 Old Colony Bldg.
New York, 3102 Hudson Terminal Bldg.
Cleveland, 2224 Union Trust Bldg.
Dallas, 1655 Praetorian Bldg.
Atlanta, 1046 Healey Bldg.
San Francisco, 1051 Rialto Bldg.

WIGGINS ROOF

RNGM2 - Gray

Mention Where You Saw the Advertisement

RECENT REFINERY PATENTS

BY STAFF REPRESENTATIVE

Washington, D. C. — The following patents of interest to the refining industry have been granted by the United States Patent Office:

No. 1,611,370, granted December 21 to John Primrose, Richmond, N. Y., assignor to Power Specialty Company, New York, for a method of dehydrating oil consisting in normally maintaining two bodies of wet oil, separately withdrawing oil from one body, heating it under pressure, reducing said pressure, separating the liquid from the vapor resulting from said reduction in pressure, and returning the liquid to the body of oil from which it was withdrawn until that body of oil is sufficiently dehydrated, abstracting heat from said vapor to condense the latter in part by transferring heat from said vapor to the body of oil not undergoing dehydration, and after said one body of oil is dehydrated similarly treating the other body of oil and replacing the dehydrated body of oil by a fresh body of wet oil and repeating the operation.

No. 1,611,615, granted December 21 to Donald Lee Thomas, New York, for a process of pyrogentically cracking hydrocarbons which consists in developing oil-vapor under pressure, reducing the pressure of said vapors by converting the pressure into velocity, supplying sufficient additional heat to the vapors while in this state of reduced pressure to effect their dissociation, progressively removing from the heated zone the dissociated vapors along with particles of tar and coke produced therein, then restoring the pressure of the vapors by reconverting their velocity into pressure and finally condensing the products so formed.

No. 1,611,669, granted December 21, to John P. Persch, Houston, Texas, assignor to Martha E. Persch, Houston, for an apparatus for treating hydrocarbon oils comprising an agitating tank, oil inlet and outlet pipes connecting thereto, means to discharge air into said tank, means whereby the temperature of said air may be suitably regulated, means to condense the volatile material arising from the treated oil, and means actuated by said air-discharge to force said condensed volatile material back into said oil.

No. 1,612,180, granted December 28 to Melvin De Groote, St. Louis, Mo., assignor to Wm. S. Barnickel & Company, Webster Groves, Mo., for a process for breaking petroleum emulsions of the water-in-oil type, characterized by subjecting the emulsion to the action of a chemical demulsifying agent, and subsequently, after an incipient tendency to break has occurred, subjecting the emulsion to electrical dehydration.

No. 1,612,265, granted December 28 to Walter M. Cross, Kansas City Mo., assignor to Gasoline Products Company, New York, for a dephlegmator comprising a shell having vapor inlet and outlet ports, a partition in the lower portion of the shell, a plurality of vertical vapor inlet pipes extending through the partition, an open top container of less diameter than the shell supported therein and forming an annular space for passage of the vapors from the bottom to the top of the shell, means positioned in the top of the shell for separating and returning the liquid material mechanically entrained in the vapors to the inner container, a coil in the annular vapor space for refluxing the heatier fractions from the vapors to a pool supported by the lower partition wherein the liquid condensate is subjected to reheating by the the heat of the incoming vapors.

No. 1,612,289, granted December 28 to Frank Atherton Howard, Elizabeth, N. J. assignor to Standard Development Company of Delaware, for a process of oil distillation for the production of light hydrocarbon oils which consists in subjecting heavier hydrocarbon oils to distillation in a still under pressure, introducing natural gas containing gasoline constituents at a temperature not substantially above atmospheric into the vapors from the distilling oils, subjecting the mixed vapors to a partial condensation, condensing the uncondensed vapors under the pressure of the still, contacting the remaining uncondensed vapors and gas with a hydrocarbon oil heavier than the condensed light hydrocarbon oil, thereby absorbing the gasoline constituents from such vapor and gas, and passing the absorbing liquid with its light absorbed hydrocarbons together with the condensate from said partial condensation into contact with the mixed vapors issuing from the still and into the pressure still.

No. 1,612,557, granted December 28 to Edwin C. Weisberger, Long Beach, Calif., for a device for separating oil from water comprising a tank having an inlet and an outlet, a series of vertically disposed baffles within and extending from the top of said tnak to near the bottom thereof and providing an uninterrupted circulating space along the bottom of said tank, certain of said baffles permitting the water to pass beneath the lower edges of same, and the oil to pass over the upper edges of same, drain pipes between said baffles, a heating means parallel with the bottom of said tank, a plurality of coils disposed at the bottom of certain of said baffles, and means to heat all of said coils separately or collectively.

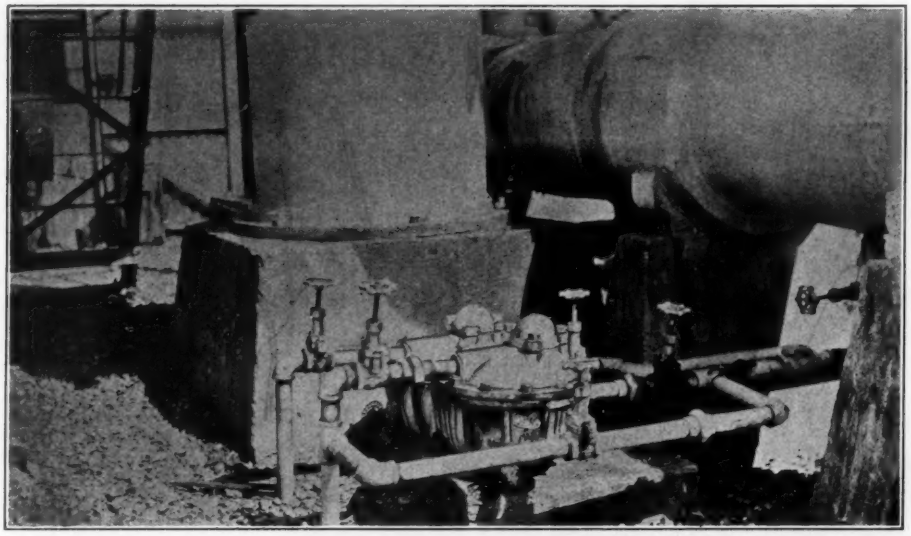
No. 1,612,572, granted December 28 to Richard B. Chillas, Jr., Philadelphia, Pa., assignor to the Atlantic Refining Company, Philadelphia, for a method of fractionally distilling a composite liquid involving interchange between rising vapors and descending reflux liquid, comprising removing a portion of the total descending reflux liquid at a predetermined point, and maintaining substantially constant the ratio of the quantity of liquid so removed to the total of the reflux liquid irrespective of variations in the rate of flow of the total reflux liquid.

No. 1,613,010, granted January 4 to Harry H. Armstrong, Los Angeles, Calif., for a process for converting heavy hydrocarbon oils which comprises heating said heavy hydrocarbons to a temperature approaching the cracking temperature thereof; heating a light hydrocarbon to substantially the cracking temperature of said heavy hydrocarbons; expanding said heated heavy hydrocarbons into a reaction chamber in a manner to atomize said heavy hydrocarbons; and expanding said heated light hydrocarbons into the atomized heavy hydrocarbons in said reaction chamber in such quantities as to maintain the temperature of said reaction chamber at the cracking temperature of said heavy hydrocarbons.

No. 1,613,016, granted January 4 to David G. Brandt, Westfield, N. J., assignor to Doherty Research Company, New York, for an apparatus for the condensation of vapors comprising a casing, a series of tubes for condensing vapors therein, and means for varying the effective condensing surface of the said tubes in accordance with the temperature of the outlet vapors.

No. 1,613,108, granted January 4 to Fred E. Hosmer, Fort Worth, Texas, for the recovery of gasoline by the refrigeration of natural or casinghead gas by contacting the vapors of gas to be cooled with a solution of a cooling medium cooled by cold gas subsequently obtained from the natural gas in a later stage of the operation.

No. 1,613,124, granted January 4 to Charles Owens, Chattanooga, Tenn., for a process of treating hydrocarbon oil which comprises drawing hydrocarbon oil into an atomizer by means of steam at substantially atmospheric pressure, atomizing said oil by said steam, drawing said atomized oil and steam into a heating zone maintained at a cracking temperature, maintaining sufficient suction on said atomizer and heating zone to draw said steam at atmospheric pressure into said atomizer and said atomized oil and steam into



FISHER Steam Trap, Type 33, removes the condensate from heat exchangers, installed in the plant of the Hull Gasoline Company, at Winfield, Kansas.

Remove the Condensate . . .

is the order given to each FISHER Steam Trap when it leaves our factory.

Failure to remove condensate as rapidly as it is formed causes a condensate to rest on the bottom of the apparatus, thereby decreasing the circulation, retarding heat transfer and reducing efficiency. The reduction of efficiency increases operating costs and wastes many dollars that might otherwise be profits.

The FISHER Steam Trap, Type 33, has been scientifically designed by the engineering department of our Company that can point to years of experience in the successful manufacture of steam specialties. It embodies the most advanced scientific principles; its mechanical construction is excellent; a series of the most exacting tests has proven its superiority.

Under all conditions, it functions properly and conduces toward the efficient operation of a plant, thereby lowering costs and saving dollars.

FISHER
TRADE MARK
REGISTERED

THE FISHER GOVERNOR COMPANY

1310 FISHER BUILDING

MARSHALLTOWN, IOWA

Mention Where You Saw the Advertisement

and through said heating zone, and condensing the resultant vapors.

No. 1,613,135, granted January 4 to Walter L. Scherer, Dallas, Texas, assignor of one-half to Clarence R. Pressley, Fort Worth, Texas, for a clarifying system for clenaing fluids comprising a cleaning machine, a storage tank, a connection between said tank and machine, means in said connection for forcing liquid from the storage tank to the machine, an auxiliary washing tank having a screen at its lower portion, a discharge connection extending from the machine to the washing tank beneath said screen, a return connection from the upper portion of said washing tank to the liquid forcing means delivering to the machine, and means for removing material from beneath the screened portion of the washing tank.

No. 1,613,269, granted January 4 to John M. Evans, San Francisco, Calif., assignor by means assignments to Standard Oil Company, of California, for a vapor line for oil tanks comprising, in a vapor recovery system, of a pair of spaced working tanks, a pipe line adapted to convey vapor between the working tanks, pressure relief means within the line and pressure relief means connected with the roof of each of said working tanks, means disposed within the pipe line and spaced from the said tanks for arresting fire, and means connected to a low point of said pipe line for the drainage of condensate therefrom.

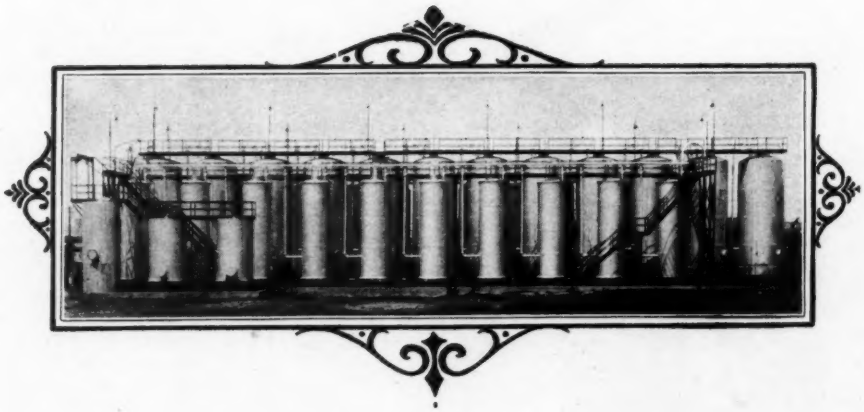
No. 1,613,298, granted January 4 to Charles Walcott Stratford, San Francisco, Calif., for a process of refining oil in a still containing a maintained quantity of oil during the stilling operation, which consists in drawing the oil from adjacent the btotom thereof to create a partial vacuum below the oil level, discharging the drawn oil under pressure in a plurality of separated streams against the inner heated surface of the still with such force and in such predetermined relation to each other as to cause each of said streams aided by said partial vacuum to form thin laterally extending, rapidly moving films of oil against the heated still surface and the several films so formed to mutually co-act to induce a rapid circulation of the oil upwardly from said heated surface to the top of the oil body and downwardly to points adjacent the heated still surface, whereby to induce a rapid circulation of the entire body of oil within the still and to cause its repeated contact with the more highly heated portions thereof.

No. 1,613,299, granted January 4 to Leon A. Tarbox, Oil City, Pa., assignor to Emlenton Refining Company, Emlenton, Pa., for a process for reviving spent fuller's earth consisting in passing the earth through a passageway in indirect heat conductive relation with heating gases applied to the passageway, in introducing air to the material in the passageway at longitudinally spaced intervals while it is being heated in sufficient quantity to burn combustible carbonaceous matreial contained therein, and in maintaining the earth in a state of agitation during such treatment.

No. 1,613,306, granted January 4 to John E. Bell, deceased, late of Brooklyn, N. Y., by Iola R. Bell, executrix, Brooklyn, N. Y., assignor to Sinclair Refining Company, New York, for an oil still comprising a firebox adjacent one end of the setting, a heating flue for conducting combustion gases from the firebox to the other end of the setting over the heating surfaces of a still arranged thereon, a pair of return flues in the setting communicating with the heating flue at the end of the setting away from the firebox and connected at their other end to a stack flue, a passage arranged between the return flues and discharging into the firebox at its near end, and air heating passages in the return flues with the air inlets at the end adjacent the firebox and discharging into the passage between the return flues at the end of the setting away from the firebox.

No. 1,613,352, granted January 4 to Julius Edward Kobemik, Fullerton, Calif., assignor to Newton Process Manufacturing Company, Fullerton, Calif., for an apparatus for absorbing light hydrocarbons, having a vertical shell with a horizontal perforate partition therein, the said partition and shell forming an absorbing medium and mixing chamber, in which is a baffle having side and top walls extending upwardly from the perforate partition and forming a slot in said partition, a

Power Piping
FOR EVERY OIL FIELD NEED
Illustrated is a condenser box coil for cracking process.
What's the problem?
It may be baffling to you, but not to Power Piping Company. Experience dictates some logical and often easy solution. "Put it up to Power Piping"—that next job of course!
Power Piping Co.,
Pittsburgh, Pa.



Why Mix Your Own?

Silvr-Cool is the super Aluminum Paint

Silvr-Cool starts where others quit
Silvr-Cool is a proven and satisfactory mixed—always ready for use—Aluminum Paint
Silvr-Cool comes out of the package as bright as it goes in

Silvr-Cool for convenience
Silvr-Cool for uniformity
Silvr-Cool for brightness
Silvr-Cool for lowest cost per year

SILVR-COOL

The Super Aluminum Paint

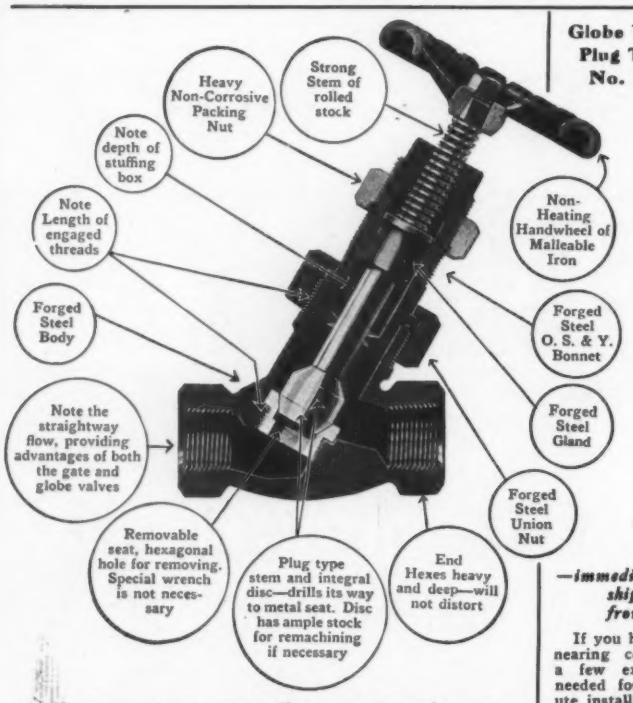
IS MADE BY

Detroit Graphite Company

DETROIT, U.S.A.

Manufactured in Canada by Dominion Paint Works Limited Walkerville, Ontario. Offices at all principal centers

Edward Forged Steel Valves


Globe Valve
Plug Type
No. 682
Heavy Non-Corrosive Packing Nut
Strong Stem of rolled stock
Note depth of stuffing box
Note Length of engaged threads
Non-Heating Handwheel of Malleable Iron
Forged Steel Body
Forged Steel O. S. & Y. Bonnet
Note the straightway flow, providing advantages of both the gate and globe valves
Forged Steel Gland
Forged Steel Union Nut
Removable seat, hexagonal hole for removing. Special wrench is not necessary
Plug type stem and integral disc—drills its way to metal seat. Disc has ample stock for remachining if necessary
End Hexes heavy and deep—will not distort

Here are two outstanding reasons why you should standardize on Edward Forged Steel Valves.

(1)—designed and built for service up to 500 pounds pressure and intermittent temperatures to 1100° degrees F.—they therefore will fit any service need within this range.

(2)—because of quantity production these high grade valves are priced LOW ENOUGH to justify their use even in service far below their maximum rating.

The Edward Valve & Manufacturing Company
Main Office and Works East Chicago, Ind.

Maintenance Engr. Corp., 1802 Conti St., Houston, Texas
Chapman Valve Mfg. Co., P. O. Box 974, Tulsa, Okla.

—immediate shipment from stock

If you have a plant nearing completion—a few extra valves needed for last minute installation — an emergency arises where valves are needed quickly—wire Edward — specify "Forged Steel Valves" — immediate shipment will be made — any quantity and any size from ¼-inch to 2-inch inclusive.

Edward Forged Steel Valves are made in both Globe and Angle pattern—Plug Type or Edward Protected Seat and Disc.

Ask for Refinery catalog.

—for every refinery service

NORTH AMERICAN CAR CORPORATION
N.A.
TANK CARS
LEASED AND REPAIRED
NORTH AMERICAN CAR CORPORATION
327 S. LaSalle St., Chicago, Ill.
Tank Cars for Lease
Domestic and Export Terminals: Chicago, Tulsa, New Orleans

partition below the perforate partition, having a slot forming a gas passage there between, walls extending upwardly from said slot into the said baffle, whereby the said walls retain the absorbing medium in the gas passage when it flows downwardly through the perforations.

No. 1,613,718, granted January 11 to Charles Lester Parmelee, West Orange, N. J., assignor to Sinclair Refining Company, Chicago, for a process of cracking hydrocarbon oils which comprises circulating oil from a supply chamber throught a heating element to a separating chamber, subjecting the oil to cracking temperature in the heating element and maintaining the oil in the separating chamber and that in the supply chamber in indirect heat exchanging relation, effecting a separation of carbon and tarry matter in the separating chamber and withdrawing the separated carbon and tarry matter, passing the clarified liquid oil to the supply chamber, collecting the vapors liberated in the separating chamber and the supply chamber and subjecting them to a refluxing operation, introducing fresh oil into the refluxing operation and passing the admixed reflux and fresh oil from the refluxing operation to the supply chamber.

No. 1,613,735, granted January 11 to Otto P. Amend, New York, for a process of converting heavy hydrocarbons into lighter hydrocarbons which consists in heating a relatively large body of such heavy hydrocarbons to a suitable cracking temperature, but considerably below the incandescent temperature of carbon, by a plurality of electric resistors of massive construction submerged in the oil and while maintaining the oil at a minimum autogenous pressure of 75 pounds.

No. 1,613,737, granted January 11 to Edward E. Bartels, Whiting, Ind., assignor to Standard Oil Company, Whiting, Ind., for a method of forming a plurality of residual products by continuous distillation of a hydrocarbon oil in a succession of stills, which comprises drawing off as a residual from an intermediate one of said stills the desired product of the lightest grade, drawing off from the end still a residue having the properties of the desired product of the heaviest grade, and blending said products to produce the desired products of intermediate grade.

No. 1,613,754, granted January 11 to Frank A. Howard and Nathaniel E. Loomis, Elizabeth, N. J., assignors to Standard Development Company of Delaware, for a method of continuously distilling oil which comprises passing oil successively through a series of stills maintained at successively higher temperatures, applying heat externally of the still, passing the vapors formed in each still successively through heat exchangers in the preceding stills, the vapors from each still admixing with the vapors from the succeeding still entering the heat exchanger in the former still.

NATURAL GASOLINE

Motor fuel is essentially a regional product, each section demanding a different quality to meet climatic conditions.

A gasoline which will give satisfactory motor performance in a warm climate will not give equally satisfactory results in a cold climate.

Gasoline suited to the climate of Florida will not give satisfactory winter service in the Dakotas.

A regional motor fuel can easily be made to meet these varying conditions by the use of proper percentages of NATURAL GASOLINE to give the necessary volatility to refined gasoline.

The program of research and road tests being conducted to determine the values of NATURAL GASOLINE has developed many new and interesting facts. Bulletins covering the progress of this work are available free to those interested on application to Research Department, Association of Natural Gasoline Manufacturers, Cosden Building, Tulsa, Oklahoma.

ASSOCIATION OF NATURAL GASOLINE MANUFACTURERS

RESEARCH DEPARTMENT ASSOCIATION OF NATURAL GASOLINE MANUFACTURERS

Oil From Coal Not Now Practical

(Continued on page 64)

lignite coals is somewhat greater than that of the bituminous coals in that they are more readily liquefied and leave behind only ten per cent of untransformed material. About fifty per cent of the nitrogen of the coal is converted into ammonia and the rest is found in the form of an organic base in the liquid products. The greatest part of the sulphur in the coal is converted into sulphurous acid and sulphur can be recovered from this gas.

The fact that lignites are so well suited for this purpose is of great importance to us in this country, for we have enormous deposits of lignite coals in the middle western states particularly which are for the most part untouched at the present time, only haphazard attempts being made to use them for fuel purposes. If ever the time comes when we will have to make petroleum from lignite, we can feel assured that there will be plenty of raw materials to draw from in our own country without having to look for supplies elsewhere.

Yield

Depending on the character of the coal that is employed for liquefaction, the yield varies between 107 and 185 gallons of oil per two thousand pounds of coal. These figures are based on the ash containing samples of coal as it is taken from the pits. It should not be thought that special types of coal only can be used for this purpose. This is not so, for all kinds of coals, excepting the real anthracites, can be employed, and the yield will vary between forty and seventy per cent, provided the ash content of the coal is not higher than ten per cent and the moisture content not more than five per cent. Of course if the ash content is higher, the yield will be less.

What the oil man is particularly interested in is the character of the products that are obtained by this process. He wants to know whether or not the oils that are made by this method are really like petroleum, and that it is possible to obtain from them gasoline, lubricating oil and similar mineral products. The answer is that the coal liquefaction products are very similar to those that are obtained from crude oil. They are not at all like the tars that are obtained from the distillation of coal at high and low temperatures. Thus it is reported by Bergius that one thousands kilograms of coal will give 150 kilograms of marketable gasoline, two hundred kilograms of a middle fraction which contains gasoline and impregnating oil and a residue from which sixty kilograms of lubricating oil and eighty kilograms of fuel oil can be obtained. When this is calculated in short tons and gallons, it means that one short ton of bituminous coal will give forty five gallons of gasoline. The endpoint of this gasoline is 437 degrees F.

It is interesting to note that the gasoline that is made by this process contains a rather large proportion of aromatic and hydro-aromatic hydrocarbons. These aromatic hydrocarbons, benzol and the like, mixed with the gasoline endow it with anti-knock properties. In an article on motalin which was published in a previous issue of The Refiner and Natural Gasoline Manufacturer, the author described in detail the results that have been obtained abroad with the use of benzol-gasoline composite motor fuels and the anti-knock properties of the motor fuel thus composed. Furthermore it is possible to dilute this gasoline, that is the product obtained from the liquefaction of coal, with normal gasoline and obtain a product which also has anti-knock properties.

The production of a good grade of lubricating oil from liquefied coal was a problem which required considerable attention and which has only recently been solved. This can now be done, and is being done on a practical scale. Cresols and xylols are also contained in the residues. These are products which are well suited for impregnating and preserving wood and the like and are of particular importance to us in that we use large quantities of cresotic oils for impregnating purposes.

It can well be understood that the technical difficulties surrounding the application of this process on a large scale were great, but Dr. Bergius reports that they have been successfully overcome. Thus one of the first difficulties concerned the feeding of coal

This cooling tower we installed for the Marland Refining Company at their Ponca City plant is the largest single atmospheric cooling tower in the United States.

Cooling Water in the Modern Refinery

Refinery engineers are finding that the best practice in regard to the use of cooling water is to have one large supply of cold water serving the various stills, interchangers, and coolers. However, these various pieces of apparatus empty their water into the hot well at different temperatures and present a cooling water problem that only an expert can solve successfully.

Our company is composed of engineers whose long experience with cooling water problems entitles them to your confidence. We have designed and built cooling towers and spray nozzle cooling systems for firms like Marland Refining Company, Humble Oil & Refining Company, Union Oil Company, Roxana Petroleum Company, and others equally well known.

Our new bulletin, just off the press, describes and illustrates our atmospheric cooling towers for refining plants. Write for your copy now.

THE COOLING TOWER COMPANY, INC.

15 John Street New York

Houston, Texas — The J. A. Rossiter Co., 410 Union Nat'l Bank Bldg.

Tulsa, Okla. — J. F. Pritchard & Co., 910 Mid-Continent Bldg.

Los Angeles, Calif. — N. O. Fleming Co., 5815 Maywood Ave., Huntingdon Park

Representatives in other principal cities

Guardians of the Pipe Lines

Why Williams Valves Stand First

Where the smoke of thousands of chimneys tell of the restless activity of the world's mightiest industries you will find Williams valves guarding the pipe lines.

In the great steel mills of the Pittsburgh and Bethlehem districts—in the refineries—shipyards—railroads and central station plants valves are installed on merit alone. Here they know metals; here they know workmanship; here, where service is most severe, tests most scientific and records most accurate, Williams valves are installed BECAUSE THEY MAKE GOOD IN EVERY WAY.

Known generally as the extra heavy line of valves, men of experience also know that this extra material is so perfectly distributed and of such superior quality that Williams Valves are really the most economical in the long run.

Until you use Williams Valves you cannot appreciate how much they will contribute to the prosperous and economical operation of your plant.

They are made in many types and sizes to suit most every industrial or power requirement.

Our dealer in your territory can supply your needs promptly

The D. T. Williams Valve Company

Cincinnati, Ohio.

Makers of High Grade Bronze and Iron, Regrinding and Nickel Seat Stop and Check Valves, Gate, Blowoff, Hydraulic, Swing and Ball Check, Needle, Hose, Whistle Valves, Stop and Air Cocks, Unions, Fittings, Water Gauges, Gauge Cocks, Oil Gauges, Lubricators, Oil and Grease Cups, Steam Traps, Separators.

Williams Regrinding Valves, No. 107 is one of the Williams Superior types that has built the Williams reputation for long, dependable service throughout industry. Discs and seats extra heavy, special metal, machined for a **tight bearing.** Seat may be reground with a little oil and emery; a few moments' work, and the valve is like new. No extra discs ever required, making an important saving. Stem, extra heavy and strong, of best bronze. Will not bend or break. All threads engaged when valve is closed, preventing stripping or unequal wear. **Exclusive** feature with the **Williams.** May be repacked under pressure with absolute safety. Sustains 200 lbs. pressure easily.

Install ONE and let it prove its value.

Foxboro Orifice Meter Installation, Floresti, Roumania

In the Roumanian Fields

As Everywhere The Foxboro Orifice Meter is Standard

Foxboro Rate of Flow Controller

For controlling the flow of mineral seal oil, charging pipe stills and charging shell stills.

Oil and Gas fields all over the world have one thing in common—the FOXBORO ORIFICE METER.

This meter is designed to measure casinghead gas with practically no loss of vacuum. When Foxboro Orifice Meters are used producers are able to maintain higher vacuums and thus get higher yields of gas and oil from the well.

The Foxboro Orifice Meter is perfectly balanced. It neither covers up nor amplifies pulsation in the line. Mercury cannot blow by the check valves. All parts are rust-proof. It operates successfully under the most severe climatic conditions. It is guaranteed permanent in calibration and is accurate to within less than 1 per cent of total scale range.

THE FOXBORO CO., INC.

Neponset Avenue, Foxboro, Mass., U. S. A.
205 So. Cheyenne Avenue, Tulsa, Okla.

New York Chicago Boston Philadelphia Pittsburgh
Cleveland Rochester Atlanta Los Angeles
Detroit San Francisco Portland, Ore

FOXBORO
REG. U.S. PAT. OFF.
THE COMPASS OF INDUSTRY

SOUTHERN CORNICE WORKS

Manufacturers of

"SOCO" STATIONARY AND REVOLVING VENTILATORS

For Refinery
And Natural Gasoline Plants

Oil Field Work A Specialty

Phone 2-1546 TULSA, OKLAHOMA 118-20 S. Cincinnati

into high pressure apparatus in a continuous stream, and also in removing the mineral residues and small portion of unchanged coal from the apparatus. The coal is now ground into small pieces and mixed with the heavy part of the oil to form paste and this is forced by pumps into the apparatus. The whole of the reaction mass consisting of gas, liquefied coal, untransformed coal and ashes are drawn out of the apparatus. The ingredients are then separated out.

Difficulties Overcome

In 1916 a plant was erected which worked under high pressure and with temperatures reaching to 400 and 500 degrees C. A pressure of 2200 to 3000 pounds per square inch is required for coal liquefaction. Larger apparatus has since been designed and has been brought to a practical running condition. Various technical difficulties were encountered and one by one they were overcome. In working with high pressures it was of course necessary to design a pressure-tight apparatus, stuffing boxes and the like that were absolutely tight, and in addition thereto the heating arrangements had to be given very close attention, for it is essential to heat to the proper temperature and avoid overheating. The control of the temperature, which when allowed to go too high results in the formation of coke instead of oil, was therefore a very important point. The heating medium was rather unique, and it had to be for it was quite impossible to think of heating the apparatus through its thick walls by a direct fire. Thus a chemically indifferent gas was employed, such as nitrogen or carbon dioxide, which was heated externally of the apparatus and then circulated through it by means of a pressure pump. Furthermore this stream of compressed gas was also utilized for removing excess heat from the reaction mass within the apparatus. The economy of this process was found to be high.

The coal is used in ground form and when it contains large amounts of ash it is generally possible to make it suitable for this purpose by flotation. The reagent is hydrogen and the economy of the entire process depends on the cheapness with which this reagent is manufactured. One rather advantageous feature of the coal liquefaction process is that, contrary to other processes in which hydrogen is employed, such as the synthesis of ammonia, it is not necessary for this gas to be used in the pure condition. Impurities in it do not affect the liquefaction and it may indeed be mixed with other gases, the principal requirement being that a sufficient concentration of hydrogen is present in the mixture.

The required hydrogen is thus manufactured by heating methane gas with steam with the result that hydrogen and carbon monoxide are formed in a mixture which contains a predominant proportion of hydrogen.

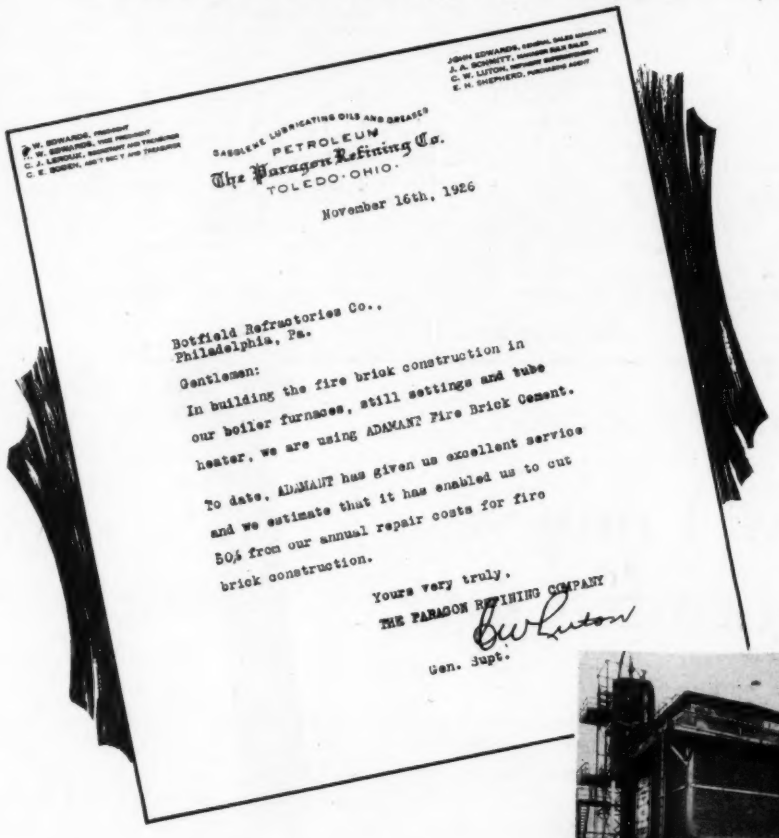
These Distributors stock ADAMANT in 100 lb., 250 lb., and 400 lb. containers. Distributors are listed under state and city, with states arranged alphabetically.

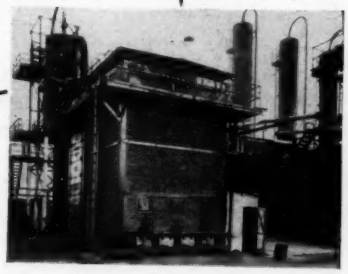
Alabama, Birmingham,
Young and Vann Supply Company
California, Los Angeles,
Industrial Supply Co.
California, San Francisco,
W. E. Mushet Co.
Colorado, Denver,
H. W. Thompson
Connecticut, New Britain,
Rackliffe Bros. Co., Inc.
Connecticut, New Haven,
The Warner-Miller Co.
Illinois, Chicago,
Wm. E. Dee Company
Indiana, Fort Wayne,
Coan Equipment Co.
Indiana, Indianapolis,
Indianapolis Belting & Supply Co.
Iowa, Des Moines,
The Walredh Supply Company
Kentucky, Louisville,
E. D. Morton & Company, Inc.
Louisiana, New Orleans,
Woodward Wight & Company, Ltd.
Louisiana, Shreveport,
Woodward Wight & Company, Ltd.
Maryland, Baltimore,
King's Coal and Supply Company, Inc.
Massachusetts, Boston,
Waldo Bros. and Bond Company
Massachusetts, Springfield,
Oscar F. Carlson
Massachusetts, Worcester,
Waldo Bros. & Bond Company
Michigan, Detroit,
H. D. Edwards & Co.
Minnesota, Duluth,
Duluth Builders Supply Co.
Minnesota, Minneapolis,
Northern Machinery Company
Missouri, Kansas City,
Union Material & Supply Co.
Missouri, St. Louis,
Reed Railway Supply Co.
Nebraska, Omaha,
American Machinery & Supply Co.
New York, Buffalo,
The Curtis Supply Co., Inc.
New York, Mohawk,
The American Hard Wall Plaster Co.
New York, New York,
C. C. Phillips, 110 W. 34th St.
New York, Rochester,
American Clay & Cement Corp.
Wm. Summerhays & Son
New York, Rome,
The American Hard Wall Plaster Co.
New York, Syracuse,
The Paragon Plaster Company
New York, Utica,
The American Hard Wall Plaster Co.
North Carolina, Asheville,
Southern Steel & Cement Company
Ohio, Cincinnati,
The Wm. T. Johnston Co.
Ohio, Cleveland,
The Cleveland Tool & Supply Co.
Ohio, Columbus,
The Westwater Supply Co.
Ohio, Dayton,
The Klinger-Dills Co.
Ohio, Toledo,
The Toledo Builders Supply Co.
Oklahoma, Tulsa,
Standard Asbestos & Cork Company
Oregon, Portland,
The M. L. Kline Co.
Pennsylvania, Aspinwall,
The Gas Combustion Company
Pennsylvania, Erie,
O. C. Thayer and Son
Pennsylvania, Pittsburgh,
The Gas Combustion Co.
Post Office Box No. 1753
Pennsylvania, Reading,
Reading Foundry and Supply Co.
Rhode Island, Providence,
B. & H. Supply Co., Inc.
South Carolina, Columbia
Columbia Supply Company
South Carolina, Spartanburg,
Spartanburg Mill Supply Co.
Tennessee, Memphis,
Reed and Duecker
Texas, Beaumont,
Norvell-Wilder Hardware Company
Texas, Corpus Christi,
San Antonio Machine & Supply Co.
Texas, Dallas,
The Murray Company
Texas, El Paso,
Geo. S. Thomson Company
Texas, Houston,
Norvell-Wilder Hardware Company
Texas, San Antonio,
San Antonio Machine & Supply Co.
Texas, Waco,
San Antonio Machine & Supply Co.
Virginia, Norfolk,
Empire Machinery & Supply Corp.
Washington, Seattle,
Crazin & Co.
Washington, Spokane,
Consolidated Supply Company
West Virginia, Charleston,
South Side Foundry & Machine Works
West Virginia, St. Albans,
Edw. C. Kirk & Sons
Wisconsin, Milwaukee,
Tewa Lime & Cement Co.
Wisconsin, Superior,
The Speakes Company

Canadian Distributors

British Columbia, Vancouver,
B. C. Equipment Company, Ltd.
Manitoba, Winnepeg,
Walter Relyea & Company, Ltd.
Ontario, Hamilton,
Thomson-Gordon, Ltd.
Ontario, Port Arthur,
Wells & Emmerson
Ontario, Toronto,
J. H. Morrison
Quebec, Montreal,
Alex. Bremner, Ltd.

This Refinery Cut 50% From Brickwork Repair Costs


J. W. EDWARDS, PRESIDENT
C. J. LEBOUR, VICE PRESIDENT AND TREASURER
C. E. BOSEN, ASST SEC'Y AND TREASURER
JOHN EDWARDS, GENERAL SALES MANAGER
A. A. SCHMITT, MANAGER R&M SALES
C. W. LUTON, DISTRICT SUPERINTENDENT
E. H. SHEPHERD, PURCHASING AGENT
GARGOYLE LUBRICATING OILS AND GREASES
PETROLEUM
The Paragon Refining Co.
TOLEDO·OHIO·
November 16th, 1926
Botfield Refractories Co.,
Philadelphia, Pa.
Gentlemen:
In building the fire brick construction in our boiler furnaces, still settings and tube heater, we are using ADAMANT Fire Brick Cement.
To date, ADAMANT has given us excellent service and we estimate that it has enabled us to cut 50% from our annual repair costs for fire brick construction.
Yours very truly,
THE PARAGON REFINING COMPANY
Gen. Supt.



In this tube heater, installed by Power Specialty Company at The Paragon Refining Company, a constant temperature of 2800°F. is maintained. Fire brick construction built with **ADAMANT** Cement.

Why Brickwork Lasts Longer When Built With ADAMANT

REFINERIES that lay up and "face" their fire brick with **ADAMANT** get thin, strong joints that bond through all temperatures—even beyond the softening point of the highest grade fire brick.

With **ADAMANT** imparting its unusual strength to a structure, cracked and open joints are eliminated. There is no bulging, creeping or traveling of walls. Naturally, the brickwork lasts longer, and repair costs are lower.

If you are interested in these economies for your refinery, communicate with us or the nearest distributor, and get the complete **ADAMANT** story.

"Whenever you use a Fire Brick Lay up, "Face" and Patch with **ADAMANT**, The Original High Temperature Cement" has become a standard specification in some of the most prominent refineries, because **ADAMANT** has proved its ability to prolong the life of fire brick construction, and to minimize refractory repair costs.

Botfield Refractories Co.

783 S. Swanson St., Philadelphia, Pa.
New York Office: 5th Floor, 110 W. 39th St.

ADAMANT
FIRE BRICK CEMENT

Furnace Design Large Factor in Fuel Economy

(Continued from page 78)

tain whatever heat transfer may be required from a square foot of heating surface, or you may obtain the exact heat transfer per second, or minute, or hour, per pound of oil being treated.

It is interesting to note the remarkably low CO^2 content desired for commercial operation and best results necessary in combustion gases with recirculation. I am not finding fault with perfect CO^2. However, as understood in general and where it is accepted as a commercial fact, there is great fault to be found with the theory. I have never concerned myself so much about theories as I have about actual results. Results, and results alone, count with me and should count with every operator in every refinery of this most noble industry.

The heat chart in the Lientz Recirculating Bulletin shows an average condition of several commercial cracking units, and is calculated upon the basis of 1000 barrels of oil throughput, oil in the unit at 350 degrees Fahrenheit, out of the unit at 900 degrees Fahrenheit, specific heat used —.83, heat absorbed by the oil—95,000 B. T. U. per minute, CO^2 carried— 5 per cent or 210 per cent excess volume, furnace temperatures 1400 degrees, spent gas temperature—900 degrees.

On this basis the standard firing conditions without using recirculation gives the following results: Total heat input—237,500 B. T. U. from fuel per minute; total heat absorbed by oil, 95,000 B. T. U. per minute or 40 per cent; heat unaccounted for, which represents radiation loss, etc., 23,750 B. T. U. per minute or 10 per cent; heat spent to the stack at 900 degrees, 118,750 B. T. U. per minute, which equals 50 per cent; pounds of gas made, 564 per minute or a total of 26,000 cubic feet per minute at 1400 degrees Fahrenheit, which gives a total gas ejected to the stack at 900 degrees of 18,615 cubic feet per minute.

With the Lientz Recirculating System, when recirculating approximately 75 per cent of the spent gases from the unit and rejecting from the air preheater the balance of the spent gases, the heat balance will be as follows: Heat in recirculated gases—87,050 B. T. U. per minute; heat returned in preheated air—17,450 B. T. U. per minute; heat required from the fuel—133,000 B. T. U. per minute.

It is readily seen that without recirculating, the heat required from the fuel is 237,500 B. T. U. per minute to carry on the operation, and by recirculation 104,500 B. T. U. per minute is conserved, made use of, and saved. This 104,500 B. T. U. reppresents 44 per cent of the total heat input, or in other words, reduces the heat input from fuel 44 per cent.

In working the heat balances for yourselves from the data I have just given you, I wish to call your attention to the fact that only 5 per cent CO^2 is used in each case. You will find the result of your heat balance shows that without recirculation the heat absorbed and unaccounted for by radiation loss, etc., is only 50 per cent, while with recirculation, allowing the same radiation loss, we account for 89.28 per cent of the total fuel input. Thus it will be seen that the heat balance and efficiency I have just given you have been based on the preventable losses which are measurable. It is not theory. It is an established fact.

However, these results are the average as I have stated, of a number of different types of cracking units. In a very efficient cracking unit or heat absorbing machine, we easily account for in our heat balance, 93 per cent of the total heat from the fuel, and in a direct firing furnace pipe still, properly constructed and insulated, we are accounting for 95 per cent of the total heat input from the fuel.

In conclusion I urge you to view your problems in high temperature furnaces from the standpoint of furnace design, as the solution lies in your obtaining the correct furnace design and construction. Likewise, in low temperature furnace problems you will find the answer to your problem of fuel economy also the answer of your maintenance cost and many other problems which I have only suggested, *in recirculation*—which must be *balanced out*, so as to make the *proper and effective application of heat.*

How Long Do Studs Last?

Not long enough if they are ordinary quality. That is why large refiners have them replaced with Aluminum Bronze as supplied by this company.

Aluminum Bronze is an alloy that would have wider use if more producers were able to solve the peculiar problems in casting it. This company is recognized by leading engineers as being pre-eminent in this field.

Aluminum Bronze is two and one-half times as strong as ordinary bronze—it has the strength of mild steel. It resists acid.

We will cast these studs, or other equipment parts that require such qualities and furnish them machined according to your specifications.

Send blue prints or data for estimate

Buffalo Bronze Die Cast Corporation
100 Arthur St. Buffalo, N. Y.

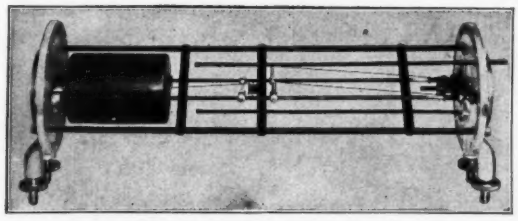
DBC

Graver Moves Offices

East Chicago, Indiana.—The Graver Corporation announces removal of its offices from the Steger Building, to Suite 705 America Fore Building, 844 Rush Street.

THE "R S" NICK OF TIME PRECISION S. G. BALANCE

Patent Applied For



Improved type of strictly portable and accurate Balance. THIS MACHINE IS BALANCED INSIDE THE CASE WITHOUT REMOVAL OF BALANCE MECHANISM. The Float is of pressed steel construction, the entire apparatus is lacquered inside and out to prevent corrosion except the Torsion Spring and Truss Wires which are Gold Plated to withstand acid reactions.

Among the many other new and exclusive features which mark the R. S. Balance are:

Removable purging tubes. Both End Rings are interchangeable and easily unscrewed. Machine may be leveled in the same manner as a Transit, adjustable leg screws. The ease of making the machine portable by adjusting a locking bar on each end.

Each, $125.00

THE REFINERY SUPPLY COMPANY

Largest Scientific Material House in the Southwest

Tulsa, Oklahoma
4th and Detroit

Dallas, Texas,
917 Santa Fe Building

FACTS ABOUT FIREBRICK JOINTS

The firebrick today remains as it has been for years, the most effective unit for use in average furnace construction.

For certain types of furnaces, Special Block and Tile for Walls and Arches are also recognized as economic units.

Thick Joints were never right and are no longer necessary. Firebrick plants now produce High Quality Brick and Tile that are true to size and shape.

Select the brick best suited to your needs, bond them with the thin air-set joint of Hytempite and you make certain the best Refractory Service.

Joints do not erode as there's practically No Joint—just a brick-to-brick surface throughout the structure.

No Shrinkage—No Cracks—No Leakage

HYTEMPITE

(REG. U. S. PAT. OFF.)

is universally used for laying up firebrick and for repairing refractory walls of furnaces and stills. 400 pounds will lay 1,000 brick.

A copy of "Hytempite In the Power Plant" should be in the possession of every plant operator and official whose duties are in any way concerned with the operation of furnaces. Write for yours.

Quigley Furnace Specialties Co., Inc.

26 Cortlandt Street **New York City**

Distributors With Stock and Service in Every Industrial Center and Oil Field

EXTRACTS OF REFINING TECHNOLOGY

Cracking Tars and Mineral Oils at Atmospheric Pressure.—The Bergius process is attracting a great deal of attention these days and investigators are comparing the results that are obtained by this process with those secured in certain modifications. Thus the article in Petroleum, 1926, volume 25, pages 947 to 949 compares the cracking of tars and mineral oils at atmospheric pressure without the addition of hydrogen with the Bergius process.

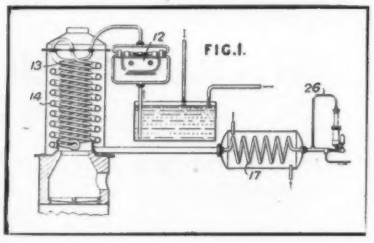
In the "berginization" of lignite mixed with coal tar, the tar cannot be recovered as such. It may be advantageous to crack the coal tar and the tar obtained from lignite, at ordinary pressures without hydrogen. The coke can be gasified and worked up into synthetic petroleum-like products by known methods. The high temperature of berginization favors the elimination of hydrogen. The unsaturated compounds arising from the original cracking process may be converted into saturated substances by treatment with hydrogen at a comparatively low pressure. Removal of unsaturated compounds by the Edeleanu process has the disadvantage that traces of sulphur dioxide are difficult to remove and extraction with organic solvents is preferable.

* * *

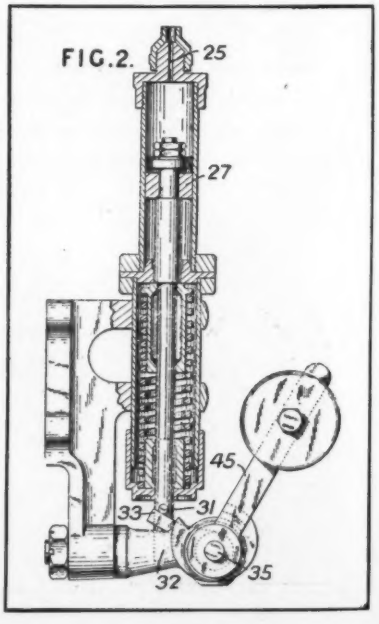
Purification of Hydrocarbon Oils.—In the purification of hydrocarbon oils by liquid sulphur dioxide the oils are first treated with sulphur dioxide gas to economize the liquid dioxide. Conveniently kerosene, gas oil or lubricating oils are trickled down a tower packed with Raschig rings or the like distributor against ascending combustion gases from a sulphur or iron pyrites kiln. British Patent No. 258,846.

* * *

Cracking Hydrocarbons. — In converting heavy into light hydrocarbons by subjecting the oils to high temperature and pressure, a small proportion of an aromatic hydrocarbon such as naphthalene is added. The pressure is preferably such as to prevent formation of vapors, and the liquid is cooled, after treatment, so that on release of the pressure only the lighter hydrocarbons are vaporized.



Oil mixed with naphthalene is forced



TRACYFIER

Refineries using Standard Specification Steam have a lower operating cost—Ask us to show you why.

Andrews-Bradshaw Co.

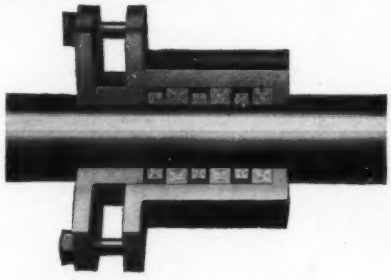
535 FOURTH AVE. PITTSBURGH, PA.

Modern Packing for Refinery Service

Gas and Air Compressors

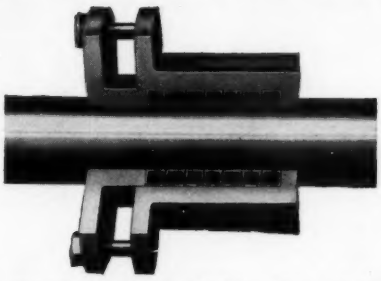
Gas and air compressor rods must run cool and continuously. Metallic packing with proper lubrication perfectly supplies this requirement. In the stuffing box below is a set of "John Crane" 104E which is a combination of 101 all-metallic and 301 resilient asbestos channel with metallic insert.

Bessemer, Cooper, Clark, Ingersoll-Rand compressors have been so equipped and installations often last over two years operating under the most difficult field conditions.



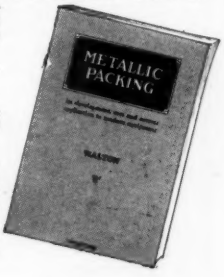
Centrifugal Gasoline Pumps

Centrifugal and rotary gasoline pumps handling gasoline present a most difficult packing problem. Gasoline washes away the entire lubricant on the face of the packing. Only a cool-running non-frictional babbitt packing is applicable if gasoline is to be handled against pressures. A combination of rings of 110 is recommended. Style 110 is asbestos core with a babbitt foil armor, presenting a non-frictional face. Many Worthington, Goulds, Manistee, Dean and Kinney pumps have been so equipped in the oil fields of the Southwest. Some installations in refineries have been in operation over two years, handling gasoline at 300 pounds pressure. Packing still giving service and sleeves in perfect condition.



The Case of Metallic Packing

This 136-page illustrated text book states the case of metallic packing from a modern engineering standpoint. It covers all present day packing services including the refinery and oil and gas service. Used in a number of engineering colleges as text book. Write stating title. Sent with manufacturer's compliments.



Crane Packing Company
1808 Cuyler Ave., Chicago, Ill.

"John Crane" Metallic Packing

RUBSHELL

SUPER PAINT

Acid Proof

Insoluble in gasoline and its vapors.

For under side of tank covers, inside condenser boxes, around treating agitators.

For tank vessels carrying gasoline and heavy oils.

Unaffected by salt water.

Sole Manufacturers

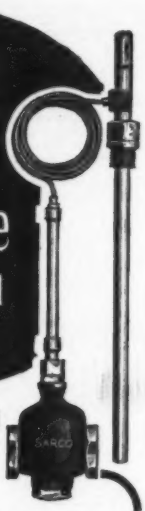
International Compositions Co.

25 Broadway, New York

Mention Where You Saw the Advertisement

IF you are depending on the hand-valve, or hit-or-miss methods of regulating temperature, the Sarco Temperature Regulator will reduce fuel consumption by not permitting the maintenance of too high a temperature, will eliminate spoilage by not allowing too much or too little heat to be used and cut labor cost by enabling operators to do other work instead of watching and adjusting the hand valves.

Take the GUESS Out of Temperature Regulation



The Sarco will automatically maintain any desired temperature without attention.

SARCO Temperature Regulator

is so simple to adjust and so positive in action that even an unskilled attendant can obtain uniform results with practically no labor or attention to the regulator.

It has no complicated mechanisms or delicate parts to get out of order or cause trouble. Requires no compressed air, electricity or other outside agencies to operate.

Is entirely self-contained. Operates on gas, steam or hot water heat.

Because of its simplicity, the Sarco costs less than other regulators and is easier to install.

Sold on 30 days' free trial. If not satisfactory in every way, simply return it and the trial will cost you nothing.

For further particulars write for Booklet S-81.

SARCO CO., Inc.

183 Madison Ave., New York City

BOSTON BUFFALO CHICAGO CLEVELAND DETROIT PHILADELPHIA

78 Oil and Refining Companies now using the

Mettler Entrained Combustion Gas Burners

For All Purposes, Kinds of Gas, Pressures

Write for Latest Condensed Catalog

Lee B. Mettler Co.

406 S. Main St. Los Angeles, Cal.

by a pump, 12, through furnace-heated coils, 13 and 14, and through a cooler, 17, and is intermittently discharged through a hand-operated valve, a spring-loaded diaphragm valve, or a rotary valve actuated by the pressure of the oil acting through a pipe, 26, upon a piston, 27, (see Fig. 2.) The movements of the piston are transmitted to the shaft, 35, of the valve by pins, 31 and 32, acting upon an arm, 33. A weighted arm, 45, on the shaft serves as a throw-over device. The shaft carries at its end a hollow conical member which rotates between two valve seatings and has ports adapted to register with ports in one of the seatings to allow passage of the oil. British Patent No. 258,656.

* * *

Increasing Viscosity of Oils by Action of the Silent Electric Discharge.—The increase of the viscosity of mineral oils, which have been subjected to the action of the silent electric discharge, is explained by the fact that perhaps the molecules of the hydrocarbons are made to lose some of their hydrogen atoms, which unite to form molecular hydrogen. Then it might be held that two such molecules, which have been deprived of part of their hydrogen content and thus have loose bonds, will combine together to form a third and much larger molecule. Wissensch. Veroeffentl, aus d. Siemens-Konzern, volume 5, pages 160 to 166.

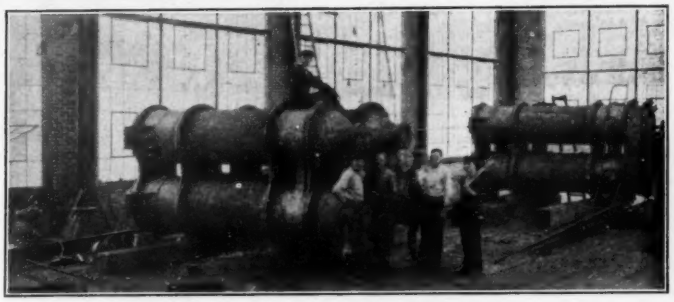
* * *

Crystallization and Sweating Out of Paraffin.—The apparatus which is used for this purpose consists of a number of cells which are arranged at definite distances from one another in an approximate horizontal position. Between each of these cells provision is made for the introduction of a heating or cooling medium as may be desired. A simplification of the construction of this apparatus lies in the avoidance of the use of air pipes between the cells for the purpose of drawing off the air in the wax chambers. The apparatus really consists of a number of closed chambers or cells which are filled with the wax or the wax mixtures and in which there is not air. The wax compartments of the apparatus are separated from one another by means of heating or cooling compartments. The apparatus gives good results. German Patent No. 434,310.

* * *

Extracting Oils or Mineral Wax From Inorganic Matter.—This process refers to the removal of oils and mineral waxes from mineral substances which have been used in the refining operations, such substances as fuller's earth, florida earth, sillicates, and the like. To this end the inorganic mineral ingredients are treated with organic alkali or alkaline earth salts, such as oleates, resinates and the like. This process has considerable advantage over the one in which various volatile

Correct design
Insures
Satisfactory
Service



Four-barrel Heat Exchangers

S & K HEAT EXCHANGERS

are designed in every case to meet specified operating conditions

Single- and Multiple-Barrel Types. **Bulletin 12-H.**

Send for Booklet showing, in condensed form, all of the S. & K. Refinery Equipment.

We are equipped to build units of large capacities.

SCHUTTE & KOERTING CO., 1253 N. 12th St., PHILADELPHIA, PA.

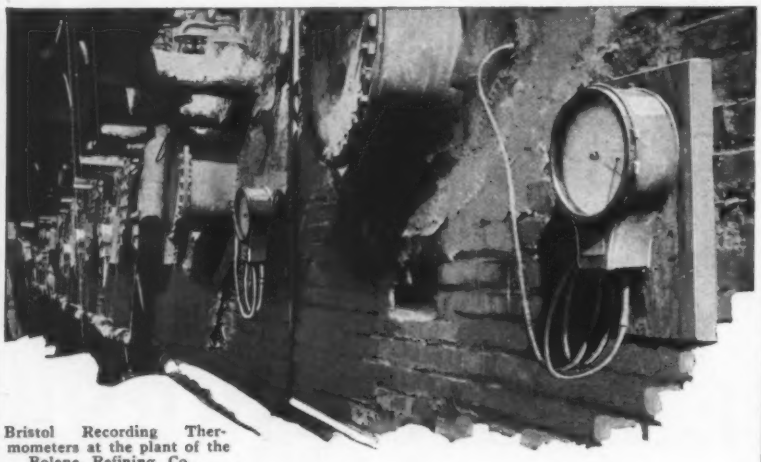
PAINTS FOR EVERY PURPOSE

For a quarter of a century Hill, Hubbell & Company have developed special paints and coatings to meet unusual conditions in many industries. If you are perplexed with the problems of protecting your plant and equipment or products, submit them to our Research Department. They will welcome the opportunity to develop the proper paint for the purpose.

HILL, HUBBELL & COMPANY

Manufacturers of Paints, Varnishes, Enamels, Biturine Coatings

SAN FRANCISCO 115 Davis Street
OAKLAND 3257 San Pablo Avenue
LOS ANGELES 331 W. Eleventh Street
SEATTLE 816 Western Avenue
NEW YORK 15 Moore Street
PORTLAND 51 First Street
BALTIMORE 600 E. Lombard Street
TULSA P. O. Box 1483



Bristol Recording Thermometers at the plant of the Bolene Refining Co., Enid, Okla.

Watch-Dogs of Heat!

Still operations run more smoothly when under the watchful eye of Bristol Recording Thermometers. They never sleep.

The ruggedness of these instruments is particularly well attested by the photograph above showing Bristol instruments designed for indoor mounting, but mounted out-of-doors and doing their work well day after day, in spite of the elements. It is service like this that gets and holds the confidence of refinery engineers.

The Bristol Company Waterbury, Connecticut

FOR 36 YEARS Ask Any Technical Engineer MAKERS OF

BRISTOL'S RECORDING INSTRUMENTS

BRANCH OFFICES:

Boston, New York, Philadelphia, Pittsburgh, Birmingham, Detroit, San Francisco, Chicago, St. Louis, Denver

GOULDS PUMPS

Pumps for All Refinery and Gasoline Plant Services

Catalogs and Bulletins on request

GOULDS PUMPS, INC.

Seneca Falls, New York

solvents, such as benzol, carbon bisulphide and the like are employed, in that it is much easier to carry out and the cost of the apparatus as well as of the reagents employed is considerably less. The danger of fire from highly inflammable solvents and the danger of poisoning from these chemicals are avoided and it is also possible to recover the reagents which are employed in the refining of the oils. German Patent No. 435,100.

* * *

Unsaturated Hydrocarbons in Mineral Oils.—According to an article published in Metall und Erz, volume 16, pages 23 ff, there is still much to be learned about the unsaturated hydrocarbons in petroleum distillates. Crude petroleum is almost free from unsaturated compounds, and they are produced in distillates by the decomposition of compounds with high boiling points.

Unsaturated hydrocarbons are produced under the most perfect method of technical distillation, and all trade products derived from petroleum contain them on a more or less degree. In ordinary straight run distillates such as gasoline they are present to the extent of about four per cent while cracked petroleum distillates contain them in considerably higher proportions.

Such unsaturated bodies are mainly olefines and diolefines. These in a pure condition do not affect the color of the distillate but on the contrary unsaturated have a bleaching action. The unwelcome coloring of stored refined products is due to the cyclic compounds, such as certain five ring bodies, among which may be mentioned cyclopenta-dienes, furane, pyrrole and their derivatives, which are contained in them.

The color which is developed in petroleum distillates ranges from a pale straw yellow to a deep red, and a deposit accompanies the coloration. Furane and its homologues will produce a brown coloration, while pyrrole and its derivatives produce mostly a red coloration. A benzol fraction containing neither furnace nor pyrrole will not change color. Cyclopentadienes in a benzol fraction produce a deposit on the bottom and sides of the container which is white in color.

The unpleasant odor of such distillates is caused through sulphur and nitrogen compounds. How far these unsaturated compounds are detrimental in a distillate depends upon the purpose for which they are to be used. For extraction purposes all olefinic compounds should be removed but in the case of motor fuel it depends upon the time it is likely to be retained in storage as to what is done with the product. For a long storage period it is desirable to treat the distillate as though it were required for extraction purposes. For quickly used motor fuel the refining can be less drastic and the

York Mechanical Refrigeration is *dependable* Refrigeration

Designed, built, installed and *guaranteed* by the world's largest organization of Refrigerating Engineers

Write for our bulletins

YORK Manufacturing Company

Ice Making and Refrigerating Machinery Exclusively

York, Penna.

METERS

Accurate, dependable instruments for measuring all kinds of oil and liquid oil products. Very durable. Can be kept up to their high initial accuracy for long periods of severe service. Standard and high pressure models. Special meters for special work.

The EMPIRE

Positive displacement, oscillating piston design. Quite different from all other types of oil meters. Easy to install and care for. Economical to maintain.

MADE IN ALL SIZES FROM 5/8 to 6 INCHES INCLUSIVE

Send for descriptive circular 110-R.

NATIONAL METER COMPANY

299 Broadway, New York

Chicago Boston Cincinnati Atlanta San Francisco Los Angeles

For Protection

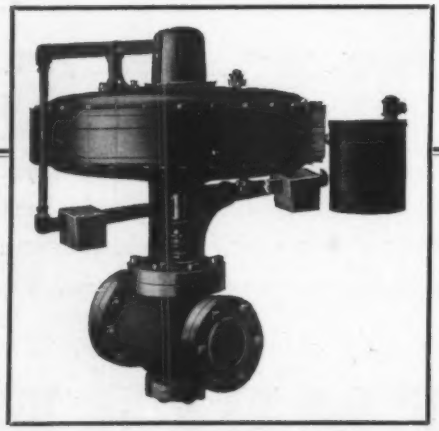
When paint spraying outside work use the New Improved Pulmosan Dustproof Aluminum Respirator.

For painting inside of tanks and tank cars use the Pulmosan Airline Mask with blower attachment.

Write for Descriptive Literature

Pulmosan Safety Equipment Corp.

384 Jay Street **Brooklyn, N. Y.**



The FULTON DUPLEX Sensitive VACUUM Regulator

When it is desirable to maintain atmospheric pressure on a system discharging gases to a line, under light vacuum, install the Fulton Vacuum Regulator.

It is especially designed for this purpose and acts as a safeguard when used on the vapor lines connected to a storage tank, for the recovery of the gases, the purpose being to prevent the pulling of a vacuum.

For thirty-five years Chaplin-Fulton equipment has been recognized for accuracy and reliability.

Write for catalogue

The Chaplin-Fulton Mfg. Co.

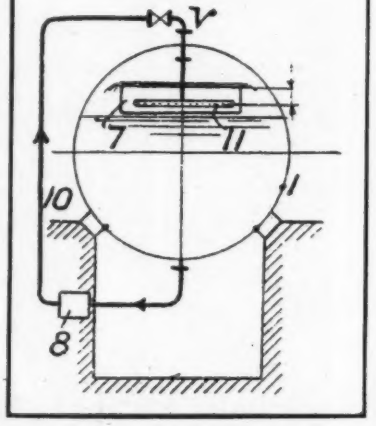
28-36 Penn. Ave. **Pittsburgh, Pa.**

olefines may be left in the gasoline. But it is always desirable to remove the diolefines. Compounds such as cyclopentadienes must also be removed. The presence of olefines in a motor fuel has the advantage of making the fuel less liable to detonation.

* * *

Distilling Mineral Oils.—In distilling mineral oils, tars and the like under

FIG. II

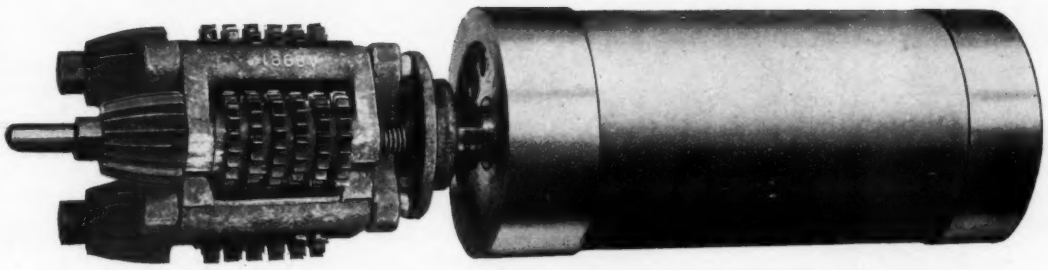


high vacuum, vaporization is effected while the heated liquid is subjected to the pressure of only a low head of liquid. The liquid heated in the base of the still, 1, is withdrawn by means of a pump, 8, and discharged through a pipe, 10, valve v and perforated pipes, 11, on a shallow tray, 7, in the upper part of the still. The liquid may be heated by heaters in the still or in the tray, 7, in the upper part of the still. The liquid may be heated by heaters in the still or in the tray, 7, or in the pipe, 10. More than one tray may be used or the tray may be dispensed with and the pipes, 11, discharge into the upper layers of liquid. The tray, 7, may be arranged in a vessel separate from the vessel, 1. The liquid may pass through a series of vessels, into each of which it is supplied on to a tray 7, fitted with a heater. Steam may be passed into hte vessels. British Patent No. 257,257.

* * *

Decomposition of Heavy Oils.—All the solid, liquid or gas forming hydrocarbons are allowed to stream into a generator which is in operation and to come in contact with a mass of incandescent carbon. The result is the decomposition of this oil into mixture of nascent hydrogen and carbon monoxide. When this happens it is possible to form a mixture of permanent gases, which can be used as a motor fuel, from these light and heavy oils which are decomposed to form both carbon monoxide and hydrogen, this action taking place in the presence of an excess of steam and carbon dioxide. French Patent No. 608,332.

ROTO TUBE CLEANERS



Roto Air-Driven Heavy Duty Cleaner
For

CRACKING STILLS

THE ROTO CO. **Sussex Avenue and Newark St.,** **NEWARK, N. J.**

WALSH FIRE BRICK

FROM COAST TO COAST

WALSH FIRE CLAY PRODUCTS CO.

ST. LOUIS
CHICAGO
360 N. MICH. BL.
NEW YORK
220 FIFTH AVE.

ASK ANY OF OUR LESSEES ABOUT CONLEY CARS

Our Equipment is in First Class Mechanical Condition

Cars for Gasoline, Fuel Oil, Lubricating Oils
Insulated Cars for Natural Gasoline

CONLEY TANK CAR COMPANY

Magnolia Bldg. DALLAS, TEXAS (*Write or Wire Our Nearest Office*) Oliver Bldg. PITTSBURGH, PA.

WHAT proportion of the leaks, blowouts, shutdowns, waste and repairs on your high pressure, high temperature lines is due to gasket failure? Let your next gasket be a METALLO, made of finest 14-oz. copper shaped into deep corrugations, each interlaid with high-grade closely woven asbestos cord, each corrugation a tight gasket in itself.

METALLO Refinery Type Gaskets of double-jacketed corrugated steel and asbestos filled, hold on 900 lbs. and 1112 deg. F. All sizes for oils, chemicals and acids.

METALLO VALVE DISCS—copper jacket completely enclosing a filler of heavy compressed asbestos packing—an elastic, resilient cushion on which valve seats close snugly. Try them for 90 days free.

Write for copy of new Metallo Catalogue—handsomely illustrated.

Metallo Gasket Company
New Brunswick, N. J.

Magnolia Building Five Gasoline Plants

Dallas. — Magnolia Petroleum Company is materially enlarging its natural gasoline plant activities by erecting three new plants in Texas and one each in Oklahoma and Arkansas. These plants vary in size from one-quarter of a million to 12 million cubic feet in daily capacity.

The most recent plant to be announced by the company includes a ten million cubic foot absorption plant to be located on the J. A. Worley land, section 39, block 24, and on the west side of the Shamrock field in Wheeler County section of the Texas Panhandle. This plant will be of the low pressure type, and will be supplied with gas that offers a yield of 1¼ gallon per 1000 cubic feet. A nine-mile gasoline line to the railroad at Lela will be necessary to make tank car shipments.

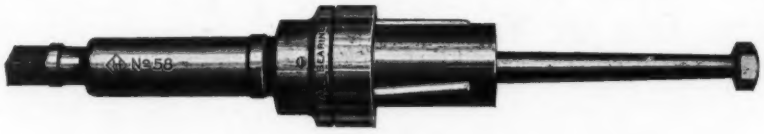
Magnolia is to purchase materials shortly for the erection of the first natural gasoline plant to be built in the Chalk shallow field, Howard County, Texas. This plant will be located on Magnolia's lease in section 113, block 29, and when completed will handle about two million cubic feet of gas daily through low pressure absorption equipment. The gasoline yield in this field amounts to about three gallons per thousand cubic feet.

Construction work has been completed on Magnolia's six unit absorption plant on the W. W. Merten lease in the Pampa-Wilcox field, Texas Panhandle district. This plant is built to handle 12 million cubic feet of gas daily, and the gas averages about one gallon per thousand.

The Seminole district in Oklahoma has been invaded by Magnolia with an absorption plant capable of handling three and one-half million cubic feet of gas daily, with a recovery of about two gallons per thousand. This plant is near Earlsboro, and is to be put on production early in February. It is a Southwestern semi-portable type. A two unit absorption plant is being completed by Magnolia to handle its own gas production from leases held in the Lisbon field, Arkansas. This plant is built to handle about three million cubic feet of gas daily, and the average gasoline yield is rated at one and one-fourth gallons per thousand. A surplus of gas production has resulted in two more units being added to Magnolia's absorption plant on the Hatfield land in the El Dorado field. Two new compressors are being added, and this new equipment will increase the gasoline production to about 5000 gallons daily.

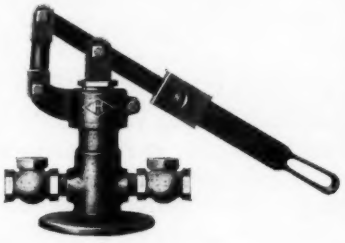
Glenn Sirrs, formerly a member of the Santa Fe Springs office force of the Standard Gasoline Company of California, has left that organization to engage in raising chickens and rabbits for market. Mr. Sirrs will be located in the vicinity of Whittier, California.

HEAVY DUTY EXPANDERS FOR STILL TUBES



TOOLS FOR THE OIL INDUSTRIES

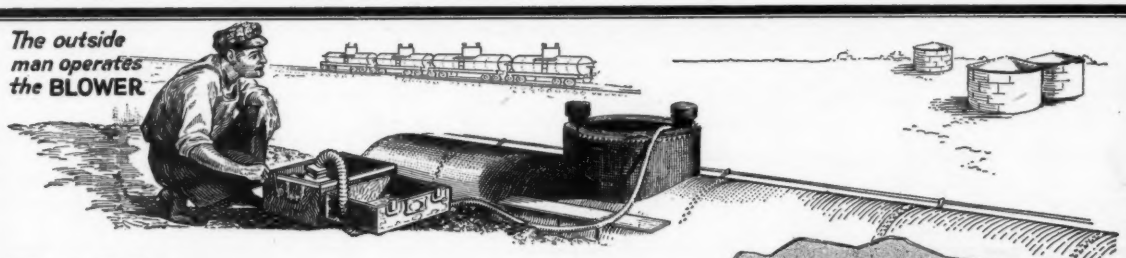
Hydraulic Pressure Pumps, 8000 pounds
Tube Expanders for Cracking Still Tubes
Hydraulic Pressure Pumps, 2000 pounds.
Tube Expanders for Condenser Tubes
Hydraulic Pressure Pumps, 500 pounds.
Tube Expanders for Steam Boilers
Screw Punches for Structural Shapes
Tube Expanders for Pipe Work
Screw Punches for Plate Work
Flaring Tools for Still Tubes
Beading Tools for Still Tubes
Hydraulic Jacks
Hydraulic Punches



A. L. Henderer's Sons

Wilmington, Del.

Established 1870 Expanders since 1884



Feed him FRESH-COOL-AIR

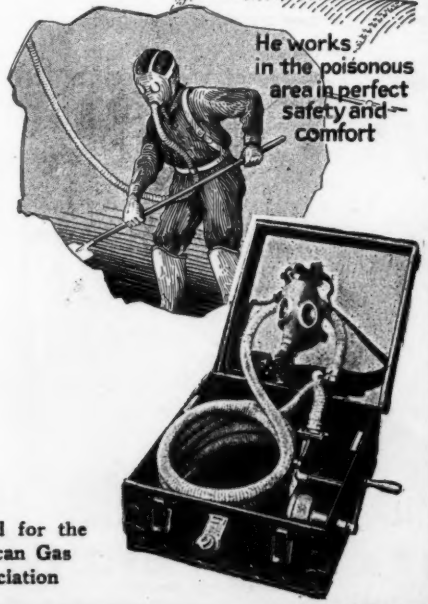
—and he'll work with greater ease, comfort and safety.

The M-S-A Standard

HOSE MASK

Supplies a continuous stream of fresh air to workers in Tank Cars, Oil Tanks, or in any confined gaseous space.

Send for Bulletin No. 99F for complete information on this and other types of Hose Masks



Mine Safety Appliances Co.

Braddock Ave & Thomas Blvd. Pittsburgh, Pa.

Standard for the American Gas Association

Mention Where You Saw the Advertisement

Mosher Separators

For Steam, Gas or Vapor Lines

are used by leading Refiners, Gasoline Plants and Gas Companies

Centrifugal
Positive
Quick

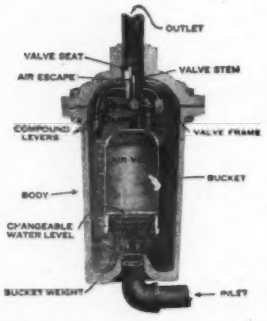
In all sizes 1" to 20". Also vertical and angle types.

"The Whirl and the Edge Does It." 99.7% Perfect Results.

The worm is stationary No revolving parts.

DRAINED with **ARMSTRONG TRAPS** which cannot waste steam or become gas bound and are self-scrubbing.

Dallas Stock



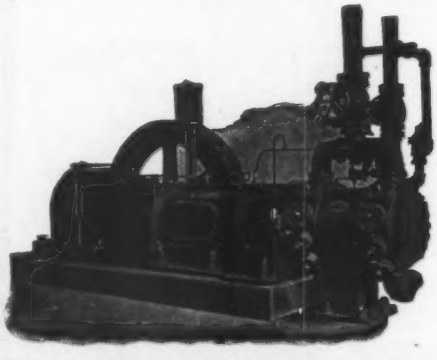
GEO. B. ALLAN & CO.

Simpson Bldg.—Dallas, Texas

Kelly Self-Grinding Valves in Stock.
Eckenroth Self-Grinding Blow-Off Valves
Cash "Standard" Reducing and Regulating Valves
McGregor Double Pump Valves, formerly called "WEMCO"
Campbell Boiler Feed-Water Regulators, easiest installed and most dependable.

Vilter **Ammonia Compressors Fittings and Pipe Coils**

Render Years of Reliable Service



Compressors built in several types and a great variety of sizes. Illustration is of a high speed type compressor.

Complete Data on Request

THE VILTER MFG. CO.

Established 1867

1152-1162 Clinton St. Milwaukee, Wis.

BRANCH OFFICE
413 Com'l Bank Bldg.
Houston, Texas

Roeser - Pendleton Build Gasoline Plant

Breckenridge, Texas.—A second natural gasoline plant for Roeser-Pendleton, Inc. in the Cook shallow oil and gas field, Shackelford County, is to be constructed immediately to handle approximately five million cubic feet of gas daily through three units. Provisions will be made to increase the size of the plant to nine units, if gas production justifies. Newton equipment has been ordered for this new plant, and a recovery of about one and one-half gallons of sweet gasoline is obtained from the gas in this district.

Roeser-Pendleton Inc.'s first plant in the Cook field is a nine unit Newton installation, and is mak'ng between 18 and 20 thousand gallons of gasoline daily. The new plant will cost about $150,000. G. P. Crutchfield is in charge of the natural gasoline department of the company, which has headquarters in the Fort Worth Club building, Fort Worth.

Building Big Gasoline Plant in Panhandle

Amarillo, Texas.—The Phillips Petroleum Company is purchasing materials to erect a natural gasoline plant of the major type on the north side of the Canadian River in Hutchinson County. Contract for the entire natural gas rights on approximately 12,000 acres of proven and semi-proven oil and gas leases held jointly by the Gulf Production Company, Walter Cline and the Panhandle Refining Company north of the river was obtained by the Phillips Petroleum Company January 4. Phillips will erect a plant to handle about 20,000,000 cubic feet of gas daily, and the lease owners will receive a one-third royalty on all gasoline produced. The gas contract becomes effective in May, 1927.

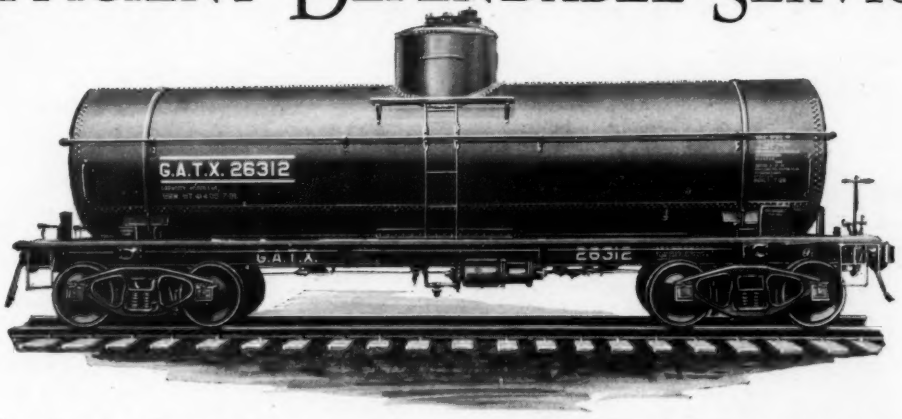
The Gulf-Cline-Panhandle Interests reserve the rights for the first call on the residue gas available after taking care of plant operation for use in drilling, lease operation and restoring pressure on the oil pay.

Gasoline Specification Change Made

Tulsa.—Changes in the Oklahoma code of inspection for gasoline have been made to allow the sale of the higher gravity gasoline under the name of gasoline. Recently, some of the concerns offering gasoline on the latest specifications were forced to offer their product as "motor fuel" or some term, other than gasoline.

The new regulations, just issued through the Corporation Commission, have been praised by refiners of the State as being fair to all manufacturers and dealers in gasoline.

EFFICIENT DEPENDABLE SERVICE



TANK CARS *of* ALL CLASSES BUILT *and* LEASED

For the TRANSPORTATION of LIQUID COMMODITIES

GENERAL AMERICAN TANK CAR CORPORATION

General Offices: ILLINOIS MERCHANTS BANK BLDG., CHICAGO, ILL.

BRANCH OFFICES:

Eastern Offices: 17 Battery Place, New York; Munsey Building, Washington, D. C.

Midwestern Offices: 1946 Railway Exchange, St. Louis, Mo.; 502 Cosden Bldg., Tulsa, Okla.

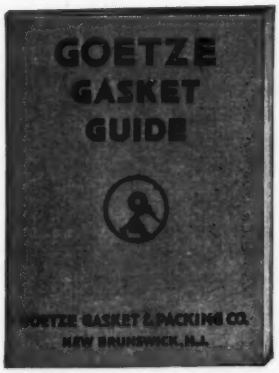
Southern Offices: Union Indemnity Bldg., New Orleans La.; Magnolia Bldg., Dallas, Texas

Pacific Coast Office Bartlett Bldg., Los Angeles, California

PLANTS: EAST CHICAGO, IND. GOOD HOPE, LA. WARREN, OHIO FORT WORTH, TEXAS SAND SPRINGS, OKLA. WICHITA FALLS, TEXAS

REPAIRING DONE AND REPAIR PARTS CARRIED IN STOCK AT ALL PLANTS.

GOETZE



Metal-Asbestos Gaskets *for* Modern Refinery Practice

Write for this 36-page "Guide"

Goetze Gasket & Packing Co.

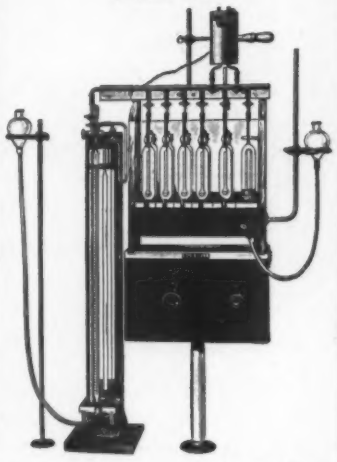
28 Allen Ave., New Brunswick, N. Y.

BURRELL

De Luxe Safety Model

Standard-Burrell Gas Apparatus

For the Gas and Oil Industries



Completely Described in the New

BULLETIN NO. 750

A copy will be sent upon request.

Burrell Technical Supply Co.

CHEMICAL-BIOLOGICAL-METALLURGICAL LABORATORY APPARATUS AND REAGENTS

1704-1708 FIFTH AVENUE PITTSBURGH, PA.

Fire Marshals Discuss Refinery Hazards

Pittsburg, Pa.—Methods of fire prevention in refineries were discussed by members of the Fire Marshal's Association of the National Petroleum Association at their second annual meeting here January 24.

Officials elected for the year are: James Herbert, Conewango Refining Company, Warren, Pa., president; James F. Sweeney, assistant superintendent Viking Oil Corporation, Clarendon, vice-president; S. R. Brown, Mutual Refining Company, Warren, secretary-treasurer.

The meeting was for one day and the chief event was an informal talk by H. E. Newell of the Flammable Liquids committee of the National Fire Protection Association. His remarks came out of his many experiences and visits to oil refineries and oil storage plants. He said the gas-tight tank had contributed largely to overcoming the fire hazard of lightning.

Each fire marshal present was given a badge by Fabette B. Dow, counsel of the National Petroleum Association.

BONER & SHELDON

Manufacturing Engineers

Fractionating Towers, Absorption Towers, Vertical Stills, Distillation Equipment.

514 Merchants National Bank Bldg.
Los Angeles, Cal.

Electrically Driven Centrifuges
Hand Centrifuges
WRITE

WILLIAMS, BROWN & EARLE, Inc.

Manufacturers of Laboratory Apparatus

918 Chestnut St. Philadelphia, Pa.

Hill Hubbell Takes New Office

San Francisco, Calif.—Hill, Hubbell & Co., manufacturer of paints and varnishes for all purposes, with headquarters office at 115 Davis Street, has found it necessary, on account of limited space in its factory at the corner of Army Street and San Bruno Avenue, to construct an additional one-story concrete factory building on these premises, containing 5200 square feet, for the manufacture of varnish. It is estimated that this expansion will increase facilities 100 per cent in the manufacture of varnish alone. This concern has sales branches in Seattle, Portland, Los Angeles, New York, and also has a factory in Tulsa. Products of this concern have nation-wide distribution.

No Temperature nor Pressure Too High!

METALASTIC INCORPORATED
JERSEY CITY, N. J.

GIRTEN BELTING & SUPPLY CO.,
HOUSTON, TEXAS

GEO. B. ALLAN & CO.,
DALLAS, TEXAS

METALASTIC
"AS SIMPLE AS LOADING YOUR PIPE"
FOR USE IN ALL KINDS OF STUFFING BOXES WITHOUT REGARD TO THEIR SIZE OR SHAPE
METALASTIC INCORPORATED

Patented and Patents pending in the U. S. and Foreign Countries

METALASTIC

For All Stuffing Box Requirements!

Have a Copy Sent to Your Home

Why depend on reading the "Office Copy" when you can get a copy of The REFINER AND NATURAL GASOLINE MANUFACTURER for your own files,—sent to your home each month for

ONLY $1.00 A YEAR

Use the Coupon NOW!

The REFINER and NATURAL GASOLINE MANUFACTURER, Box 1307, Houston, Texas.

Gentlemen: Please find enclosed one dollar (check or currency will do) for which send me your publication for one year.

Name .....

Street and No. .....

City ..... State .....

I am with the ..... Company

(Refinery Dept.) (Natural Gas Dept.)
(Scratch one) and my position is:

Executive Chemist
Superintendent Stillman
Assistant Superintendent Other Employee

Mention Where You Saw the Advertisement

SEAMLESS STEEL STILL TUBES

Thousands of Babcock & Wilcox open hearth seamless steel still tubes are in service in refineries throughout the country.

These tubes have been supplied to various specifications, either with plain ends or upset as ordered.

Many of them are thirty feet long, made hot finished by a process perfected by this Company, for tubes of unusually long length.

The more common sizes are carried in stock at the Mill for immediate shipment.

THE BABCOCK & WILCOX TUBE CO

Works: Beaver Falls, Pa.

General Sales Office: 85 Liberty Street, New York

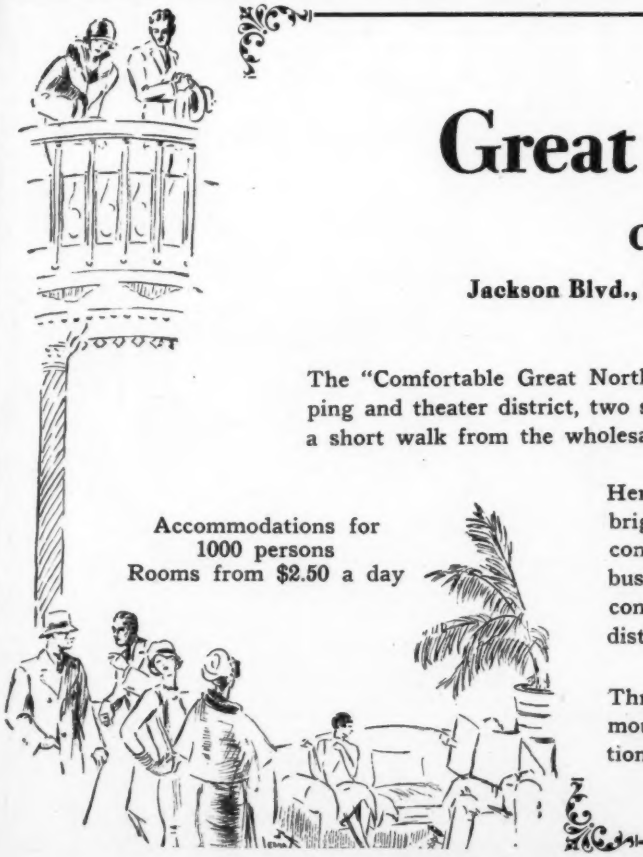
BRANCH OFFICES

CHICAGO .....Marquette Building
BOSTON .....49 Federal Street
PHILADELPHIA ..... Packard Building
PITTSBURGH ...Farmers Deposit Bank Building
CLEVELAND .....Guardian Building
CINCINNATI .....Traction Building
ATLANTA, GA. .....Candler Building
NEW ORLEANS .....344 Camp Street
HOUSTON, TEXAS.....Electric Building
DALLAS, TEXAS .....Magnolia Building
GALVESTON, TEXAS .....414 Security Building
SAN ANTONIO, TEXAS .....
.....511 Builders Exchange Building

THE BABCOCK & WILCOX TUBE CO. TUBES

BRANCH OFFICES

AMARILLO, TEXAS, ...208 Polk Street
PHOENIX, ARIZONA.....Heard Building
DENVER .....444 Seventeenth Street
SALT LAKE CITY .....Kearns Building
SEATTLE .....L. C. Smith Building
SAN FRANCISCO .....Sheldon Building
LOS ANGELES .....Central Building
PORTLAND, OREGON .....Gasco Building
HAVANA, CUBA .....Calle de Aguiar 104
SAN JUAN, PORTO RICO ..Royal Bank Building
HONOLULU, H. T.....Castle & Cooke Building



Great Northern
Hotel
CHICAGO

Jackson Blvd., Dearborn and Quincy Sts.

The "Comfortable Great Northern" is conveniently located in the shopping and theater district, two squares from the financial center and just a short walk from the wholesale section.

Accommodations for 1000 persons
Rooms from $2.50 a day

Here at rates considerably moderate are large, bright, livable rooms, excellent service and the conservation environment of a substantial business institution patronized by leading, conservative environment of a substantial distinguished guests with their families.

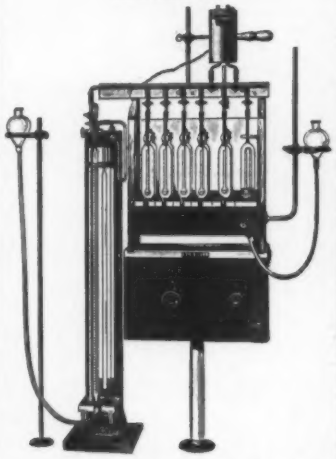
Throughout all departments, including the famously good restaurants, considerate moderation of charges prevails.

BURRELL

De Luxe Safety Model

Standard-Burrell Gas Apparatus

For the Gas and Oil Industries



Completely Described in the New

BULLETIN NO. 750

A copy will be sent upon request.

Burrell Technical Supply Co.

CHEMICAL- BIOLOGICAL- METALLURGICAL LABORATORY APPARATUS AND REAGENTS

1704-1708 FIFTH AVENUE PITTSBURGH, PA.

Fire Marshals Discuss Refinery Hazards

Pittsburg, Pa.—Methods of fire prevention in refineries were discussed by members of the Fire Marshal's Association of the National Petroleum Association at their second annual meeting here January 24.

Officials elected for the year are: James Herbert, Conewango Refining Company, Warren, Pa., president; James F. Sweeney, assistant superintendent Viking Oil Corporation, Clarendon, vice-president; S. R. Brown, Mutual Refining Company, Warren, secretary-treasurer.

The meeting was for one day and the chief event was an informal talk by H. E. Newell of the Flammable Liquids committee of the National Fire Protection Association. His remarks came out of his many experiences and visits to oil refineries and oil storage plants. He said the gas-tight tank had contributed largely to overcoming the fire hazard of lightning.

Each fire marshal present was given a badge by Fabette B. Dow, counsel of the National Petroleum Association.

BONER & SHELDON

Manufacturing Engineers

Fractionating Towers, Absorption Towers, Vertical Stills, Distillation Equipment.

514 Merchants National Bank Bldg.
Los Angeles, Cal.

Electrically Driven Centrifuges
Hand Centrifuges
WRITE

WILLIAMS, BROWN & EARLE, Inc.

Manufacturers of Laboratory Apparatus

918 Chestnut St. Philadelphia, Pa.

Hill Hubbell Takes New Office

San Francisco, Calif.—Hill, Hubbell & Co., manufacturer of paints and varnishes for all purposes, with headquarters office at 115 Davis Street, has found it necessary, on account of limited space in its factory at the corner of Army Street and San Bruno Avenue, to construct an additional one-story concrete factory building on these premises, containing 5200 square feet, for the manufacture of varnish. It is estimated that this expansion will increase facilities 100 per cent in the manufacture of varnish alone. This concern has sales branches in Seattle, Portland, Los Angeles, New York, and also has a factory in Tulsa. Products of this concern have nation-wide distribution.

No Temperature nor Pressure Too High!

METALASTIC
"AS SIMPLE AS LOADING YOUR PIPE"
FOR USE IN ALL KINDS OF STUFFING BOXES WITHOUT REGARD TO THEIR SIZE OR SHAPE
METALASTIC INCORPORATED

METALASTIC INCORPORATED
JERSEY CITY, N. J.

GIRTEN BELTING & SUPPLY CO.,
HOUSTON, TEXAS

GEO. B. ALLAN & CO.,
DALLAS, TEXAS

Patented and Patents pending in the U. S. and Foreign Countries

METALASTIC

For All Stuffing Box Requirements!

Have a Copy Sent to Your Home

Why depend on reading the "Office Copy" when you can get a copy of The REFINER AND NATURAL GASOLINE MANUFACTURER for your own files,—sent to your home each month for

ONLY $1.00 A YEAR

Use the Coupon NOW!

The REFINER and NATURAL GASOLINE MANUFACTURER, Box 1307, Houston, Texas.

Gentlemen: Please find enclosed one dollar (check or currency will do) for which send me your publication for one year.

Name .....

Street and No.....

City ..... State.....

I am with the..... Company

(Refinery Dept.) (Natural Gas Dept.)
(Scratch one) and my position is:

Executive — Chemist
Superintendent — Stillman
Assistant Superintendent — Other Employee

SEAMLESS STEEL STILL TUBES

Thousands of Babcock & Wilcox open hearth seamless steel still tubes are in service in refineries throughout the country.

These tubes have been supplied to various specifications, either with plain ends or upset as ordered.

Many of them are thirty feet long, made hot finished by a process perfected by this Company, for tubes of unusually long length.

The more common sizes are carried in stock at the Mill for immediate shipment.

THE BABCOCK & WILCOX TUBE CO

Works: Beaver Falls, Pa.

General Sales Office: 85 Liberty Street, New York

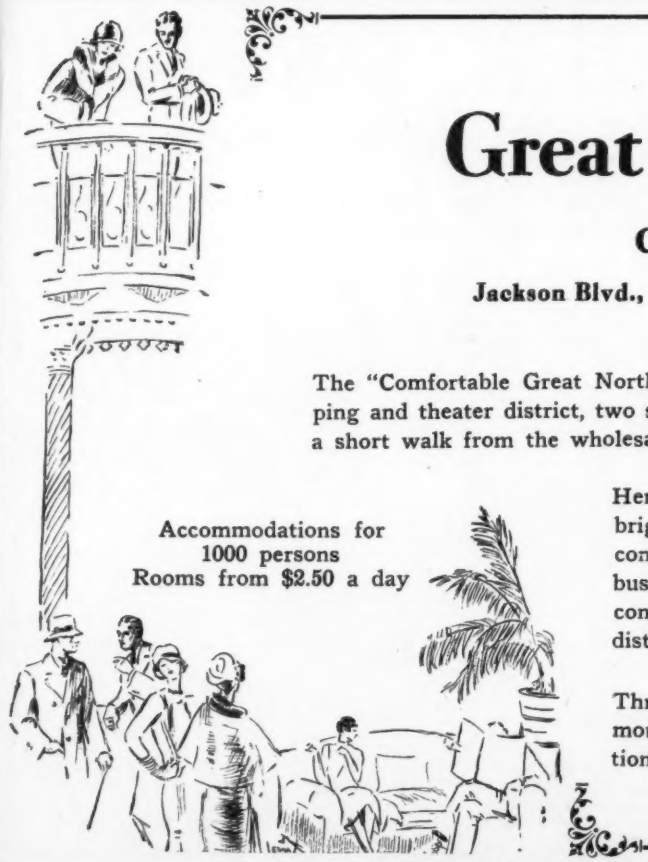
BRANCH OFFICES

CHICAGO .....Marquette Building
BOSTON .....49 Federal Street
PHILADELPHIA .....Packard Building
PITTSBURGH ...Farmers Deposit Bank Building
CLEVELAND .....Guardian Building
CINCINNATI .....Traction Building
ATLANTA, GA. .....Candler Building
NEW ORLEANS .....344 Camp Street
HOUSTON, TEXAS.....Electric Building
DALLAS, TEXAS .....Magnolia Building
GALVESTON, TEXAS .....414 Security Building
SAN ANTONIO, TEXAS .....
.....511 Builders Exchange Building

THE BABCOCK & WILCOX TUBE CO. TUBES

BRANCH OFFICES

AMARILLO, TEXAS, ...208 Polk Street
PHOENIX, ARIZONA.....Heard Building
DENVER .....444 Seventeenth Street
SALT LAKE CITY .....Kearns Building
SEATTLE .....L. C. Smith Building
SAN FRANCISCO .....Sheldon Building
LOS ANGELES .....Central Building
PORTLAND, OREGON .....Gasco Building
HAVANA, CUBA .....Calle de Aguiar 104
SAN JUAN, PORTO RICO ..Royal Bank Building
HONOLULU, H. T.....Castle & Cooke Building



Great Northern
Hotel
CHICAGO

Jackson Blvd., Dearborn and Quincy Sts.

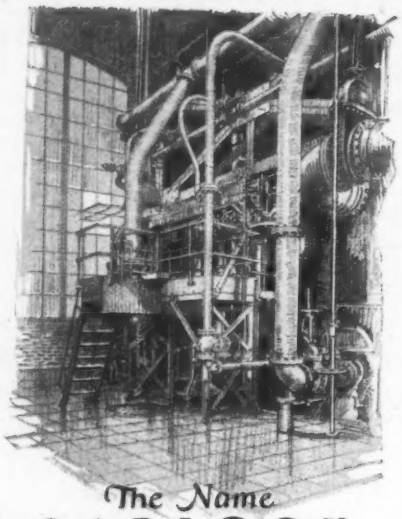
The "Comfortable Great Northern" is conveniently located in the shopping and theater district, two squares from the financial center and just a short walk from the wholesale section.

Accommodations for 1000 persons Rooms from $2.50 a day

Here at rates considerably moderate are large, bright, livable rooms, excellent service and the conservation environment of a substantial business institution patronized by leading, conservative environment of a substantial distinguished guests with their families.

Throughout all departments, including the famously good restaurants, considerate moderation of charges prevails.

GARLOCK
TRADE MARK



The Name
GARLOCK
Is Known in Every Plant Where Packing Service is Economically Essential

The name "Garlock" and the words "Packing Service" are synonymous to the Mechanical Packing Trade.

This condition developed from the origination of a Mechanical Packing Service by The Garlock Packing Company, to carry through the idea of servicing its Quality Controlled Products so that correct application of the packing would resolve itself into the complete satisfaction of the user.

The results obtained from the plan have proved to Purchasing Agents, Mechanical Departments and Engineers that it is the only method to use in buying packings where economical and efficient practices are essential.

Garlock Commodities cannot enter competition where initial price only is considered, but they will win out "thumbs down" when the ultimate costs are finally checked.

Garlock Packing Service is the gratis consultation on Packing Problems offered by over one hundred and fifty Garlock Service Men who have headquarters in all parts of the world. They will recommend the correct application of Quality Controlled Packings which are produced and inspected in our own factories, by trained craftsmen. The crude materials, the carcass structure and the method of lubrication are continually checked, in order to maintain Garlock Standards, by our Physical, Chemical, Experimental and Research Laboratories.

GARLOCK
MECHANICAL PACKING SERVICE

The Garlock Packing Company
Palmyra, New York

Sales Offices and Warehouses in all Principal Industrial Centers

The Standard Packing of the World

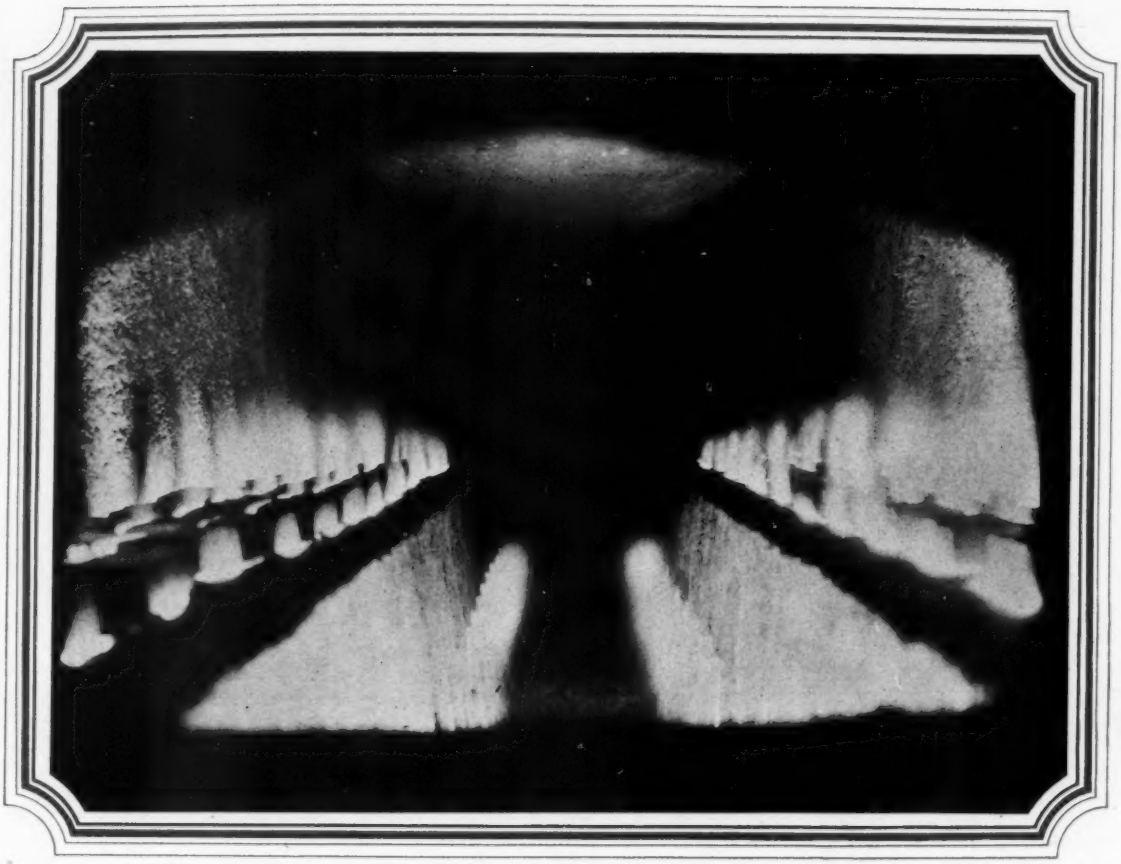
ADVERTISING INDEX

Ac-Me Company 5
Allan & Co., George B. 126
American Cast Iron Pipe Company 42
American Paint & Supply Company 4
American Radiator Company 34
Association of Natural Gasoline Manufacturers 109
Andrews Bradshaw Company 116
Babcock & Wilcox Tube Company 129
Banner Rock Products Company 8
Bessemer Gas Engine Company 6
Braun & Company, C. F. ..... Inside Front Cover
Bristol Company 120
Brown Instrument Company ..... Insert, Opposite 81-83
Boner & Sheldon 128
Botfield Refractories Company 113
Buffalo Bronze Die Cast Corporation 114
Burrell Technical Supply Company 128
Campbell, J. A. 10
Cook Paint & Varnish Company 101
Conley Tank Car Company 124
Chestnut & Smith Corporation 9
Clark Bros. Company 86-87
Chaplin-Fulton Manufacturing Company 122
Chicago Bridge & Iron Works 103
Cooling Tower Company 110
Cooper Company, C. & G. 48
Crane Packing Company 117
Crosby Steam Gauge and Valve Company 89
Detroit Graphite Company 107
Edward Valve & Manufacturing Company 108
Electric Controller Manufacturing Company 85
Elliott Company 12
Fisher Governor Company 105
Foxboro Company, Inc. 112
Garlock Packing Company 130
Gasoline Recovery Corporation 37
General American Tank Car Corporation 127
Goulds Pumps, Inc. 120
Gray Processes Corporation 13
Great Northern Hotel 129
Griscom-Russell Company 25
Goetze Gasket & Packing Company 127
Graver Corporation ..... Front Cover
Hammond Iron Works 97
Henderer's Sons Company, A. L. 125
Hill, Hubbell & Company 119
Hills-McCanna Company 17
Hope Engineering & Supply Company 18
International Compositions Company 117
Kaw Steel Construction Company 7
Johns-Manville Corporation 22
Kellogg Company, M. W. 41
Kerotest Manufacturing Company 46
Laclede-Christy Clay Products Company 11
Liberty Manufacturing Company 16
Lientz Oil Company, B. P. 99
Lummus Company, Walter F. 20
Lunkenheimer Company 21
McDonald Manufacturing Company, A. Y. ..... Back Cover
Metric Metal Works 14
Mettler Company, Lee B. 118
Metallastic, Inc. 128
Metallo Gasket Company 124
Midwest Piping & Supply Company 42
Merco-Nordstrom Valve Company 27
Mine Safety Appliances Company 125
National Meter Company 121
National Transit Pump & Machine Company 44
Neilan, Schumacher & Company 3
National Airoil Burner Company 95
North American Car Corporation 108
Ohio Steel Foundry Company 39
Oil Conservation Engineering Company 38
Paige-Jones Chemical Company 93
Pennsylvania Forge Company 29
Plibrico Jointless Firebrick Company ..... Inside Back Cover
Pittsburgh Steel Products Company 33
Power Piping Company 106
Power Plant Equipment Company 25
Power Specialty Company 30
Pulmosan Safety Equipment Company 122
Quigley Furnace Specialties Company 115
Refinery Supply Company 115
Roto Company, The 123
Sarco Company 118
Southwestern Engineering Corporation 19
Smith Separator Company 75
Southern Cornice Works 112
Schutte & Koerting Company 119
Smith Corporation, A. O. 15
Struthers-Wells Company 40
Sun Company 28
The Texas Company 32
Texas Firebrick Manufacturers Association 26
United States Rubber Company 80-81
Universal Oil Products Company 90
Vilter Manufacturing Company 126
Vogt Machine Company, Henry 31
W. K. M. Company, Inc. 23
Walworth Manufacturing Company 77
Walsh Fire Clay Products Company 123
Wheeler Condenser and Engineering Company 35
Westcott & Greis 36
Winkler & Koch 79
Williams, Brown & Earle 128
Williams Valve Company, D. T. 111
York Manufacturing Company 121

1927

X

.. 5
..126
.. 42
.. 4
.. 34
..109
..116
..129
.. 8
.. 6
Cover
..120
81-83
..128
..113
..114
..128
.. 10
..101
..124
.. 9
86-87
..122
..103
..110
.. 48
..117
.. 89
..107
..108
.. 85
.. 12
..105
..112
..130
.. 37
..127
..120
.. 13
..129
.. 25
..127
Cover
.. 97
..125
..119
.. 17
.. 18
..117
.. 7
.. 22
.. 41
.. 46
.. 11
.. 16
.. 99
.. 20
.. 21
Cover
.. 14
..118
..128
..124
.. 43
.. 27
..125
..121
.. 44
.. 3
.. 95
..108
.. 39
.. 38
.. 93
.. 29
Cover
.. 33
..106
.. 25
.. 30
..122
..115
..115
..123
..118
.. 19
.. 75
..112
..119
.. 15
.. 40
.. 28
.. 32
.. 26
80-81
.. 90
..126
.. 31
.. 23
.. 77
..123
.. 35
.. 36
.. 79
..128
..111
..121



There's one near you

IN almost every field there is at least one installation of the Plibrico Diffusing Furnace. We'll gladly tell any refinery man where he can see the Diffusing Furnace in operation.

The in-operation photo above shows the uniformity of heat distribution for the entire length of the still that is obtained with this ingenious furnace design (patents applied for).

This uniform heat distribution makes five definite economies:

1—Shortens the time cycle.

2—Gives positive still temperature control.

3—Absolutely eliminates bagging of bottoms.

4—Reduces fuel consumption.

5—Lengthens refractory life.

We will gladly explain in detail how these economies are effected.

The Diffusing Furnace is easily adapted to existing stills at very low cost. It can be used with new stills of any type—shell, pipe, tube, or combination.

SEND BLUEPRINTS

Our engineering department will gladly prepare blueprints showing an adaptation of the Diffusing Furnace to your stills—without obligation. Send blueprints or rough dimensioned diagrams of your contemplated or existing stills, being sure to show the type of breeching outlet and whether the side walls are straight or slanting.

Plibrico Jointless Firebrick Co.

1865 Kingsbury Street, Chicago

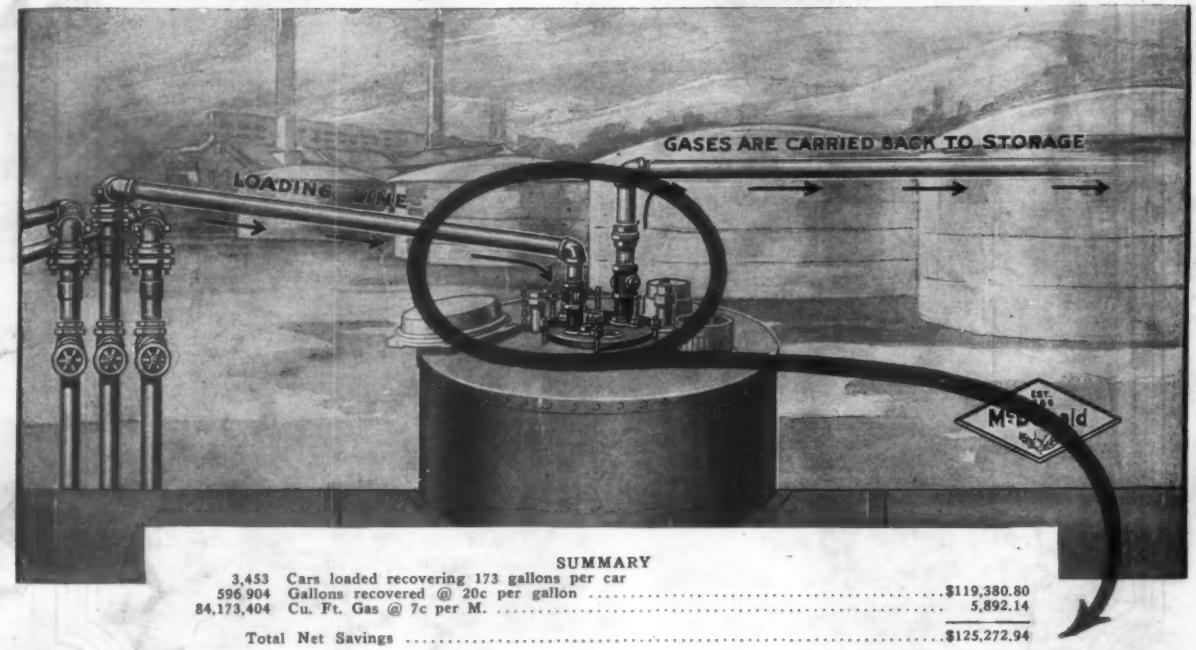
Factories: Chicago and Trenton; offices in 90 cities

Largest producers of plastic refractories

The PLIBRICO Diffusing Furnace

—for any new or existing still, oil or gas fired

$125,272 Saved In 17 Months



SUMMARY

3,453	Cars loaded recovering 173 gallons per car	
596,904	Gallons recovered @ 20c per gallon	$119,380.80
84,173,404	Cu. Ft. Gas @ 7c per M.	5,892.14
	Total Net Savings	$125,272.94

By Use of Universal Gastite Dome Covers

Made for temporary attachment to dome; also in heavier style for permanent attachment. May be used both on insulated and uninsulated tank cars. Patented 10/14/1924.

Over $125,000 turned from loss to profit in 17 months! These startling figures are taken from actual records kept by an Oklahoma Refiner.

The Universal Gastite Dome Cover affects savings ranging from 2 to 8 barrels for every car loaded because

1. It provides an absolutely gastite cover for dome of tank car.
2. Gases, instead of evaporating, are piped back to storage.
3. A relief valve set at 2 to 5 pounds pressure can be set on vent outlet allowing blended or straight run gasoline to be loaded under pressure.
4. By eliminating escaping gases, explosions are prevented.
5. Cars can be loaded 24 hours a day, rain or shine.

Such tremendous savings and advantages cannot be ignored. Write us for full information on Universal Gastite Dome Covers.

"The Home of the Swing Joint"

A. Y. McDONALD MFG. CO.

Dubuque, Iowa

Omaha Minneapolis Des Moines Kansas City

There's a McDonald Distributor Near You

McDONALD